Mining CONGRESS JOURNAL

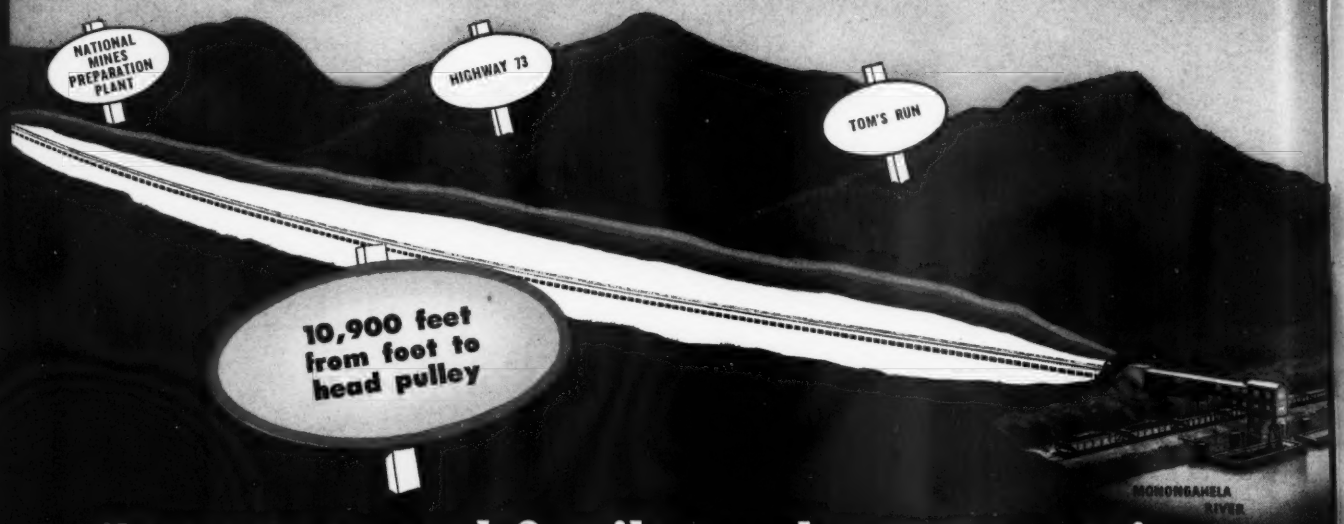
AMERICAN MINING CONGRESS

FEBRUARY 1951

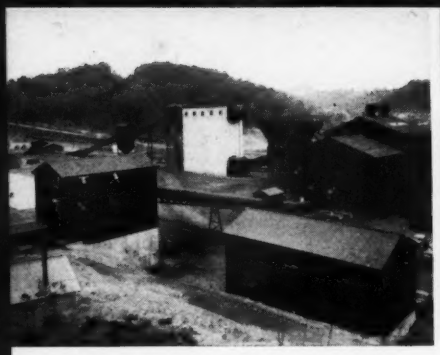
ANNUAL REVIEW

COAL • METAL • NONMETAL

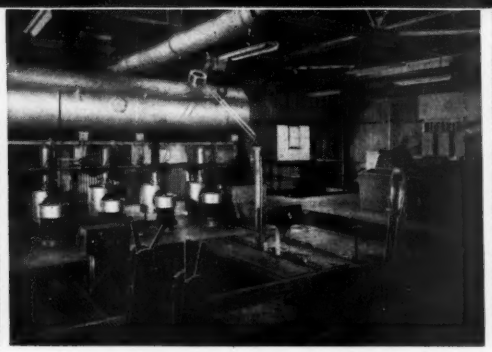
World's longest single belt conveyor...



transports coal 2 miles under a mountain...



Link-Belt engineered throughout — transfer house (left center), washery (top right), blending bins (background).



In washery — one of two Link-Belt Air-Pulsated Washers, Aeropoised-controlled.

River and rail loading station is Link-Belt throughout including by-pass conveyor, barge shifter.

...engineered and built by LINK-BELT

Another example of how LINK-BELT fulfills complete unified responsibility

Here's the assignment National Mines Corp., Morgantown, W. Va., handed Link-Belt —

Move coal over two miles from preparation plant to river and rail loading station — through rough country — at the lowest overall cost per ton. Thorough analysis of all factors determined that the best solution was a belt conveyor in a tunnel — through mountainous terrain, under forests, roads and streams. To eliminate intermediate transfers, heavy machinery and power wiring in the tunnel, it was decided to build the conveyor in a single flight.

The result — today that 10,900-foot "highway" is the world's longest single belt conveyor. It transports 216 tons of coal per hour or Link-Belt standardized Series 100 Idlers — is driven through Link-Belt Enclosed Gear Drives, Bearings and terminal machinery.

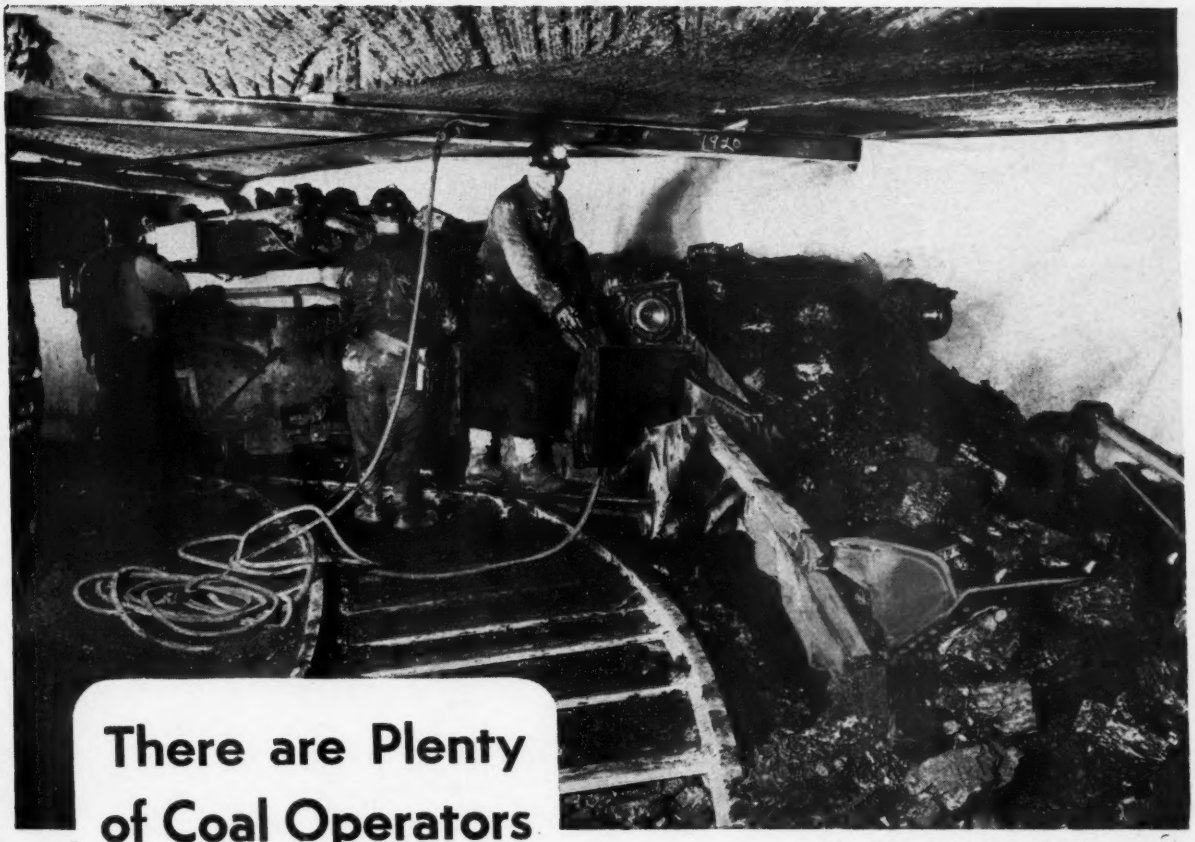
But that's only part of Link-Belt's over-all responsibility. Complete blending and coal preparation plants — engineered and built by Link-Belt — clean and wash 4" x 0" coal. And at the river, the barge and rail loading station carries the Link-Belt name.

Big or small — car dumping, cleaning, sizing, conveying, refuse disposal — Link-Belt has the right answer for each. Draw on the broad experience of Link-Belt engineers.

LINK-BELT COMPANY: Chicago 9, Philadelphia 40, Pittsburgh 13, Wilkes-Barre, Huntington 9, W. Va., Louisville 2, Denver 2, Kansas City 8, Mo., Cleveland 15, Indianapolis 6, Detroit 4, Birmingham 3, St. Louis 1, Seattle 4, Toronto 8, Springs (South Africa). 12,280

LINK-BELT

COAL PREPARATION and HANDLING EQUIPMENT



The Whaley "Automat" loading coal in one of the industry's largest mines.

There are Plenty of Coal Operators who need the Production Dependability of the Whaley "Automat"

There are many mines, of course, where Whaley "Automat" Loading Machines are not used. But it isn't because the operators don't need them. The plain fact is—they just haven't investigated the "Automat."

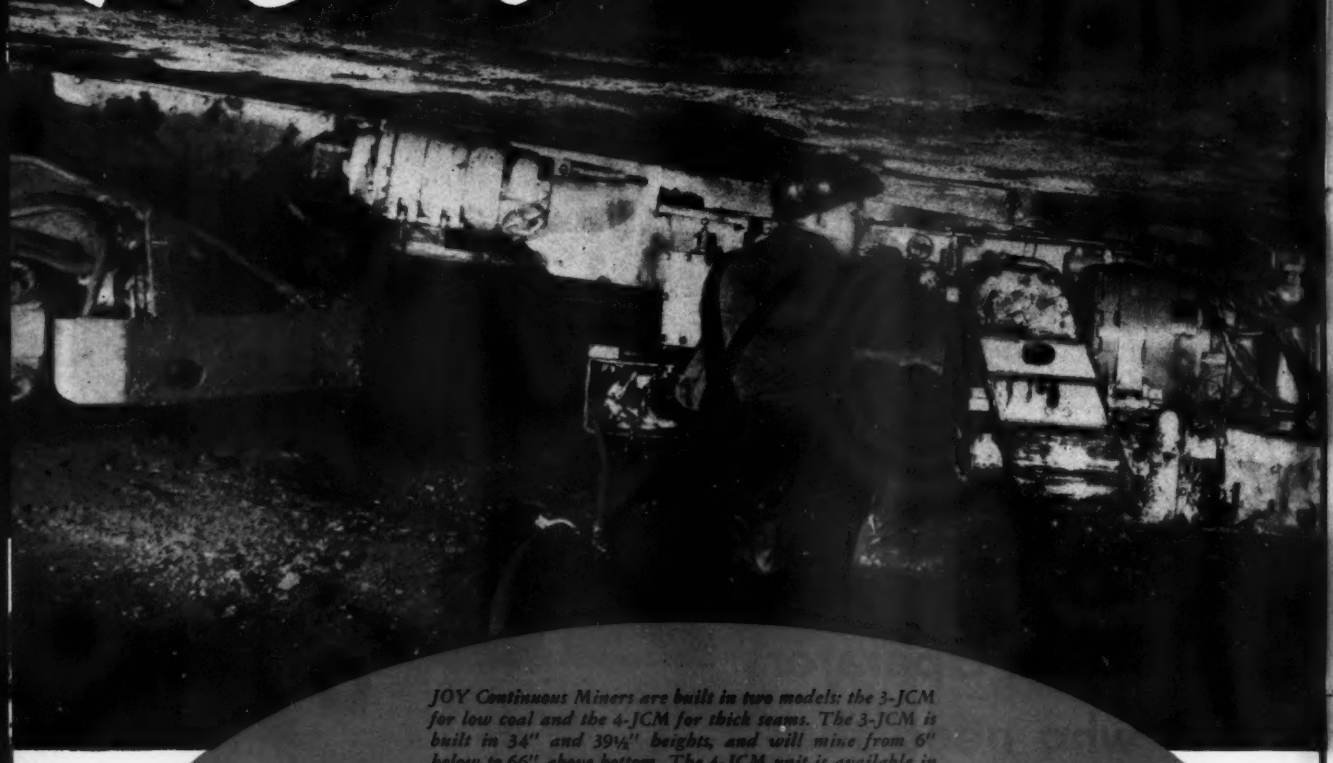
Any coal mine operator will acknowledge that loader breakdowns are extremely costly . . . more today than ever. The loader that can stay on the job day-in and day-out . . . the loader you can rely on for production dependability is the only machine worth buying.

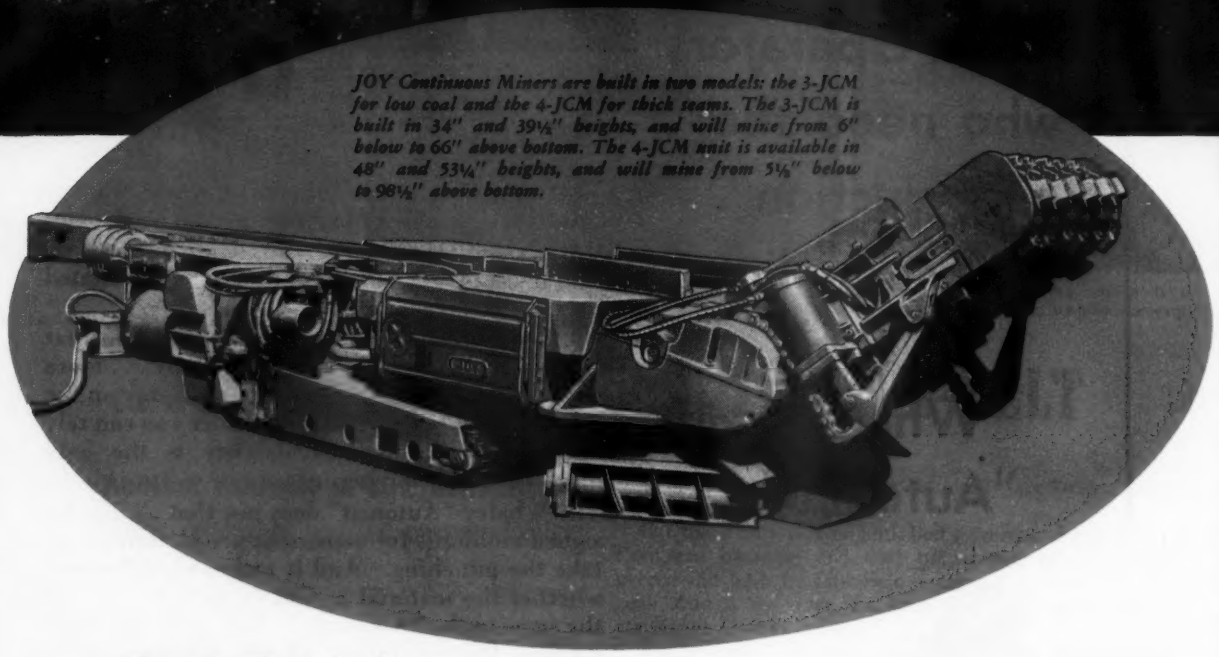
The Whaley "Automat" does just that . . . it's designed and built for consistent production . . . to take the punching. And it makes no difference whether the material is coal or rock . . . it's all the same to the "Automat." You need the "Production Dependability" of the Whaley "Automat." Investigate it now.

MYERS-WHALEY

"MECHANICAL LOADERS EXCLUSIVELY FOR OVER 40 YEARS"

NOW! More than 100





JOY Continuous Miners are built in two models: the 3-JCM for low coal and the 4-JCM for thick seams. The 3-JCM is built in 34" and 39½" heights, and will mine from 6" below to 66" above bottom. The 4-JCM unit is available in 48" and 53¼" heights, and will mine from 5½" below to 98½" above bottom.

Above: The 100th JOY CONTINUOUS MINER in the plant and on the job

This 100*th* JOY Continuous Miner, a 3-JCM machine, was shipped in September, 1950 and went on the job a few weeks later, in November—the fourth Continuous Miner in that particular operation. With well over a hundred Miners now in service around the world, each additional machine furnishes added testimony that the JOY Continuous Miner is definitely a *field proved* unit —established by performance as the greatest single advance in coal mine mechanization today for safety and low-cost, high-tonnage production.

in Highly Successful Use!

JOY CONTINUOUS MINERS

are Cutting Costs and Increasing Tonnage in every coal-mining field from coast to coast in the U.S.-and in several foreign countries.

Let us work with you to secure the best advantage from modern mechanized mining practice in your operations.

Consult a Joy Engineer

CL 3475

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

HAULAGE KEEPS PACE WITH PRODUCTION ON

Exide-Ironclad BATTERY POWER

Keep your mine haulage equipment moving at top speed, all day long, with Exide-Ironclad Batteries. They respond instantly and fully to all power demands—continuous or intermittent. And their large reserve power is ample for emergency needs. Exide-Ironclad Batteries also assure you:

ROUND-THE-CLOCK-PERFORMANCE—no unscheduled down time, no mechanical trouble, no slow-downs toward end of shift.

LOW OPERATING COSTS—easy and inexpensive to keep charged, absorb very high percentage of charging current, and return it in useful work.

EASY MAINTENANCE—rugged construction assures trouble-free operation, low maintenance and repair costs.

EXCEPTIONALLY LONG LIFE—proved in thousands of heavy-duty jobs. Less to charge off for depreciation.

INHERENT SAFETY—freedom from hazards of fire, explosion and personal injury.

WIDE RANGE OF EXIDE-IRONCLAD SIZES for all makes of battery-powered locomotives, trammers and shuttle cars.

Write for FREE copy of the new Exide Motive Power Bulletin.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto
"Exide-Ironclad" *Reg. Trade-mark U. S. Pat. Off.*

1888...DEPENDABLE BATTERIES FOR 63 YEARS...1951

JULIAN D. CONOVER
Editorial Director

JOHN C. FOX
Editor

Associate Editors
A. W. DICKINSON
G. B. SOUTHWARD
H. L. MOFFETT

Production
B. C. WILKERSON
J. J. WARD

Mining CONGRESS JOURNAL

Advertising
P. D. MCMURRER, Mgr.

FRANK W. MORAN
(Chicago)

RALPH F. DUYSTERS
(New York City)

RALPH W. HARKER
(Los Angeles and San Francisco)

Contents

VOLUME 37, NUMBER 2 FOR FEBRUARY, 1951

FRONT COVER: Loading operations at Grande Ecaille Mine of Freeport Sulphur Co.
Editorials 32
ANNUAL MINING REVIEW
The Authors 33-35
Modern Mechanical Coal Mining 36
By JAMES L. HAMILTON
Metal Mining Practice 40
By VINTON H. CLARKE
Coal Preparation 43
By R. L. LLEWELLYN
Advances In Mineral Dressing 47
By STRATHMORE R. B. COOKE
Copper 50
By C. H. WINSHIP, JR.
Lead in 1950 51
By GLOYD M. WILES
Zinc 53
By R. J. MECHIN
Coal Research 55
By J. W. IGOE and H. J. ROSE
Iron Ore 59
By WILLIAM S. CUMINGS
Strip Mining of Coal 62
By WILLIAM L. BURT
Industrial Minerals 64
By J. L. GILLSON
Anthracite 67
By C. M. DODSON
Domestic Supplies of Strategic Minerals .. 69
By DAVID D. BAKER
Advances in Underground Transportation.. 71
By P. R. PAULICK
Potash 74
By G. F. COOPE
Bituminous Coal Industry 81
By G. A. LAMB and J. L. ZIERCHER
Sulphur 84
By R. KIRBY SHIRLEY
AEC Raw Materials Program 86
By STAFF MEMBERS, USAEC
Overhead Roof Support 90
By AUREAL T. CROSS and PAUL H. PRICE
Mining Geology and Exploration 93
By F. S. TURNEAURE
Coal Mine Equipment Sales 96
By W. H. YOUNG and R. L. ANDERSON
Phosphate Rock Industry 99
By J. L. WEAVER
Gold Mining 102
By DONALD H. MCLAUGHLIN
Silver 104
By HON. PAT MCCARRAN
Aerial Exploration 106
By HOMER JENSEN
1951 Coal Show 108
Wheels of Government 110
Personals 112
News and Views 114
Manufacturers Forum 126

Opinions expressed by authors within these pages are their own, and do not necessarily represent those of the American Mining Congress

Indexed regularly by Engineering Index, Inc.

Copyright 1951, by

THE AMERICAN MINING CONGRESS
1102 RING BLDG., WASHINGTON 6, D. C.

HOWARD I. YOUNG, *President* · DONALD A. CALLAHAN, *Vice President* · ANDREW FLETCHER, *Vice President* · WILLIAM J. JENKINS, *Vice President* · JULIAN D. CONOVER, *Secretary*

Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign, $5.00. Single copies, $0.30. February Annual Review Issue, $1.00. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

Member Audit Bureau of Circulation.

NOW TWO MORE *Completely New*

HD-9

WEIGHT: 18,500 lb.
70 DRAWBAR Hp.
GM 4-71 DIESEL ENGINE
SPEEDS: 6 forward, to 5.68 mph.;
3 reverse, to 4.43

OUT AHEAD

Modern Allis-Chalmers Line sets New Tractor Standards

Each of these four Allis-Chalmers crawlers gives you a new yardstick for rating tractors. Each brings you a new kind of performance . . . plus new strength, operator comfort and service simplicity. For the finest in crawler tractors, see your Allis-Chalmers dealer.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

The World's Most Modern Line of Crawler Tractors

Allis-Chalmers Tractors

NEW POWER RATING

POWER, WEIGHT, BALANCE put them in a class of their own — never such traction . . . such pulling, pushing or lifting ability. And the smooth-operating GM 2-Cycle Diesel engines work without strain under the most extreme conditions.

NEW STRENGTH

All parts are designed and built to carry their loads with a margin of safety. No need to go to a larger tractor just for strength alone. The HD-9 and HD-15 set new standards for tractor quality.

- ✓ For Greater Production
- ✓ For Easier Operation
- ✓ For Simplified Servicing

NEW DESIGN SIMPLICITY . . .

for Easier Control and Greater Operator Comfort—Easy-shift transmission • Self-energizing brakes • Booster steering controls • Adjustable, cushioned seat • Wide arm rests • Convenient controls and pedals • Full visibility • Instant electric starting.

for Simplified Servicing—Unit construction permits removing major assemblies without disturbing companion groups • Extended lubrication periods throughout—1,000 hours on truck wheels, idlers and support rollers.

Complete Line of Matched Equipment, Developed in Cooperation With Allied Manufacturers, Available For Both The HD-9 and HD-15.

HD-15

WEIGHT: 27,500 lb.
102 DRAWBAR Hp.
GM 6-71 DIESEL ENGINE
SPEEDS: 6 forward, to 5.80 mph.; 3 reverse, to 4.51

NEW Le Roi CLEVELAND

Here are the SDR-34 Features that Revolutionize Shaft Sinking

Save You Time! Save You Money!

1. Air motor and jumbo screw mechanism for fast, easy adjustments. No slippage — good, positive set-up for complete drilling round.
2. Patented 2-to-1 air feed cylinder with chain drive. Positive feeding action for maximum drilling speed, minimum bit-wear. Six-foot changes eliminate steel handling for increased footage.
3. Model H23 Sinker. Weight 83 pounds. 3" bore provides plenty of rotation power and force of blow for fast drilling in all types of rock. Chucks for: 1" hex x 4¼", 1" or 1¼" round lug or popular quarter octagon sizes.
4. Line Oiler. Easy to fill, provides positive lubrication to the machines.
5. Drill Steel Centralizer. Opens and closes quickly. Makes hole collaring faster and safer.
6. Holes can be drilled at any angle. Adjustments are made quickly and easily by MDR air motors. You get better breakage for faster mucking.
7. Complete self-contained unit. Reduces handling time and effort. Speeds up shaft-sinking cycle for lower costs.

Specifications

LE ROI-CLEVELAND SDR-34 MULTIPLE DRILL SHAFT SINKER

Weight	1900 lbs.
Width in closed position	5'6"
Length	14'
DR34 air-shell travel	7'
DR34 air-shell steel change	6'
H23 chuck size	1" hex x 4¼ shank 1" or 1¼" round lug, or popular quarter octagon sizes

Can be furnished with 45 to 55 lb. Le Roi Cleveland H10 DR Drills—and for extremely hard rock conditions either the 3½-inch bore D-25 Drifter or the 4-inch bore D-14 Drifter.

SDR-34 Shaft Sinker

Drills 42-hole round in only 1/3 the time

required by two 55-lb sinker drills

Complete self-contained rig revolutionizes shaft sinking — speeds drilling — reduces steel handling — cuts costs!

HERE'S an example of how the new SDR-34 rig takes the headaches out of shaft sinking:

On a recent shaft job, the SDR-34 unit drilled out a 42-hole round (each hole 6 ft. deep) in less than an hour. On the same job it took two 55-lb. hand-held drills (3 steel changes) over three and a half hours to drill out this 42-hole round.

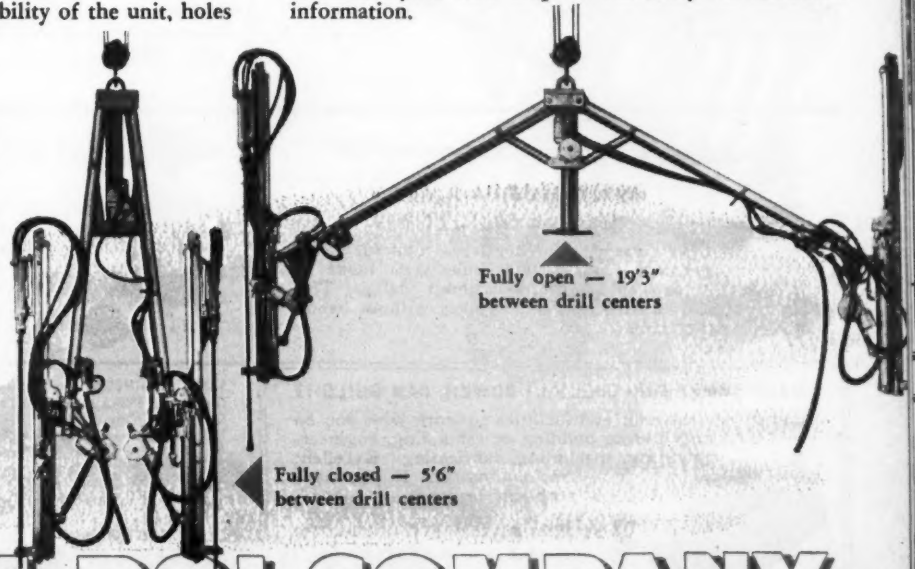
Obviously, savings such as this in drilling time do much to cut shaft sinking costs.

Moreover, because of the flexibility of the unit, holes can be drilled in the proper location and at the right angles to insure breakage for faster mucking. Again, you save!

Operators are less tired at the end of the shift, too. Using six-foot steels with tungsten carbide bits eliminates extra steel handling. And centrally located controls make the drill runner's job just that much easier.

Simplify your next shaft-sinking job with the SDR-34 and watch your costs drop! Write today for additional information.

The SDR-34 is a self-contained unit consisting of two famous Le Roi-Cleveland air-feed shells with two well known and popular Cleveland drills, air and water hoses, line oilers, drill-steel centralizers. Self-contained feature allows it to be dropped or withdrawn from shaft as a unit. Saves handling time. Gets round started faster for lower costs. MDR air motors make positioning fast, and easy — control arm-spread and drill angle through famous mine-jumbo screw mechanism.



LE ROI MILWAUKEE

LE ROI COMPANY

CLEVELAND DIVISION • *Manufacturers of* CLEVELAND ROCK DRILLS

12500 Berea Road, Cleveland 11, Ohio

BOWDIL PRODUCTS

HELP YOU GET MORE $$$ FROM THAT MINE OF YOURS

NEW TELESCOPING TRANSIT SUPPORT

For use in all types deep mining, especially efficient for conveyor mining. As rigid as a prop, sturdily constructed of aluminum and stainless steel. Lightweight, easily, quickly sets up correct height for transit. Main column graduated on 2 sides in 1/100 foot.
Three standard lengths telescoping from 3 to 5 ft., 5 to 8 ft., and 8 to 12 ft. in height. Special lengths furnished on request.

BOWDIL BITS

Patented concave design increases bit clearance, assures longer wear without increased power consumption. Made from special steel, rolled, with concave faces. Tests in hundreds of mines have proven these Bits last 15% to 20% longer. Bowdil makes the right size and shape bit for every mining condition, to fit all types of chain.

BOWDIL CUTTER BAR

Bowdil Cutter Bars are designed for extra strength and power saving. Rivet-free body, Z bar construction, wide wearing strips make it the sturdiest bar in mining. Bowdil Bars are standardized to fit all coal mining machines.

FABRI-FORGE CHAIN

Lower your operating costs with Bowdil Fabri-Forged Chain. Rugged, easy to maintain, the drop-forged lug body stands up under heavy wear with breakage practically eliminated. A major improvement is the true-running radial track guide.

BOWDIL FAST ROPE SOCKET

You can save time with the Bowdil Rope Socket . . . takes just two minutes to install. No tools necessary. High tensile-strength steel and patented design give maximum strength.

REPLACEABLE POINT MINER'S PICK

With a Bowdil Miner's pick, it only takes a few seconds to replace a dull, blunted point with a sharp one. Light or heavy, Bowdil pick heads are perfectly designed for weight and balance, come with or without wood handle.

ALLOY STEEL AUGERS AND DRILL BITS

Uniform temper and shape eliminate almost all possibility of "grabbing." The use of special heat-treated alloy steels not only makes them last longer, but adds an important safety factor.

BOWDIL DRILL BITS

Any bit requirements can be met from Bowdil's complete line. Fish-tail auger bits, four-point auger bits and two-point clay bits are available in a number of different sizes . . . all made from Bowdil's specially treated steel for long and efficient service.

DETACHABLE JAW SPIKE PULLER

Small, easy to handle . . . pays for itself many times over. Detachable jaws make it possible to replace claws without delay. The special construction pulls spikes without bending them.

SPROCKETS FOR ALL MINING MACHINES

Bowdil Sprockets are made from special heat-treated alloy steel and designed for hard wear. Our stock of over 100 different styles includes clutch, spline and keyed types—various tooth designs of 4 to 13 teeth.

WANT SOMETHING SPECIAL? BOWDIL CAN BUILD IT

Bowdil has the staff and facilities to work with you on any custom building or rebuilding, engineering, machining, fabricating. Excellent heat-treat equipment. If you have a problem, bring it to Bowdil.

BATTERY OPERATED MINE LOCOMOTIVE DESIGNED AND BUILT BY BOWDIL

SALES ENGINEERS IN—Whitesburg, Kentucky—West Frankfort, Illinois Charleroi, Pennsylvania — Denver, Colorado — Big Stone Gap, Virginia Danville, West Virginia — Canton, Ohio — Birmingham, Alabama Helper, Utah—Kansas City, Missouri—Centerville, Iowa—Topeka, Kansas New Castle, England — Alberta, Canada

SALES AGENTS FOR *The Cincinnati* **ELECTRIC DRILL**

BOWDIL

COAL CUTTING EQUIPMENT

CANTON OHIO

Here's why ANACONDA Shuttle Car Cable is the best you can buy

Problem: Moisture can be tough on mine cables.

Solution: ANACONDA Mine Cables are made with COLD RUBBER Type RH Insulation—are not only much more resistant to moisture, but also to overheating.

Problem: Short-radius action over sheaves induces conductor fatigue, hastens cable failure.

Solution: More effectual stranding of Anaconda conductors means more resistance to fatigue.

Problem: Mine service subjects cable to frequent and severe crushing and cutting action. Leads to shorts.

Solution: ANACONDA Mine Cables have an improved (30% tougher) neoprene jacket—withstand much more crushing and cutting action. Besides, there's the patented anti-short breaker strip for extra protection.

Problem: Mine service often subjects cable to severe tensile strains which can lead to cable destruction.

Solution: ANACONDA Mine Cables have a new s-t-r-e-t-c-h-a-b-l-e ground wire which greatly increases cable life under excess tension. Furthermore, special neoprene-treated glass cord reinforces the protective insulation and jacket.

Problem: Tough new cable problems are being presented by the severe cable requirements of the new, continuous mining machines.

Solution: Anaconda has the answer in a new, specially designed cable for continuous mining machine and shuttle car service. 51351

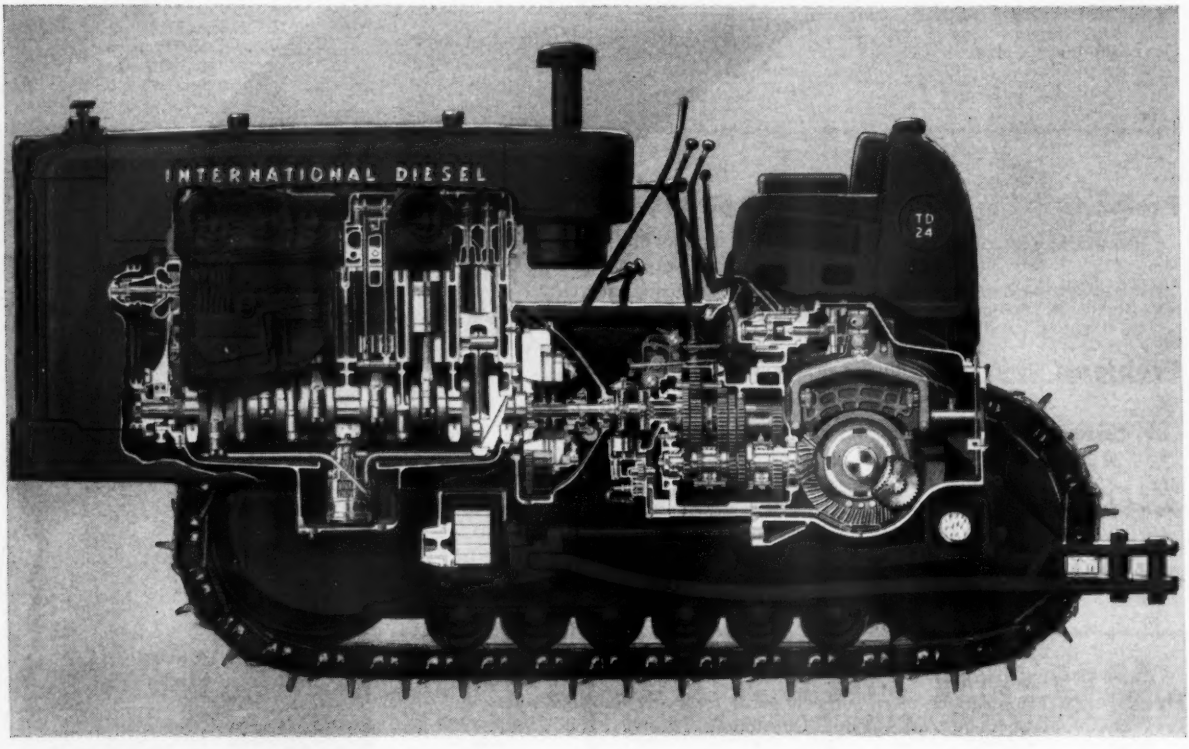
and that isn't all!

For complete information, get in touch with your nearest Anaconda Sales Office or Anaconda Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

the right cable for the job ANACONDA®

WIRE AND CABLE

GUTS OF A CHAMP



Inside story of the TD-24

When two-legged people have guts, they finish the fight and do the job.

Real guts—that's what the world admires—man or machine.

You can't define what makes guts in a man, but you can "analyze" the fighting, working, dogged innards of the Champ. So let's put the X-ray on the TD-24:

Drawbar Horsepower: 148 working horsepower delivered at the drawbar in official tests.

Synchromesh Transmission: you "shift on-the-go," with eight speeds forward, eight reverse for faster time cycles.

Instant Speed Change: up or down one speed without declutching.

Planet Power Steering: all turns are easier . . . pivot turns, feathered turns, turns with power on both tracks.

Reserve Torque: gives the Champ the lugging ability to fight through temporary overloads.

Easy Steering: finger-tip hydraulic controls.

All-Weather Starting: push-button, gasoline-conversion starting—an International exclusive—gets you on the job fast.

More Work: the TD-24 is doing more work—with more speed and more lugging ability—than any other crawler tractor on the market.

Look it over. Then ask your International Industrial Distributor to show you what it can do for you. You'll be a TD-24 man from then on in.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

INTERNATIONAL INTERNATIONAL HARVESTER **POWER THAT PAYS**

GOODMAN MEETS THE *continued demand*

FOR SHORTWALL CUTTING MACHINES

TYPE 512 GOODMAN SHORTWALL

A proved leader FOR UNDERCUTTING COAL EFFICIENTLY!

Wherever you find the shortwall method of cutting used, you're almost sure to find the Goodman Type 512. It has exceptional endurance for heavy work, is easy to operate, has long life with low maintenance, and, with the Bugduster unit provides automatic control of cuttings.

The Goodman Bugduster is now available for the Types 12, 112, and 512 Shortwalls; and design work is completed for adapting to the Types 212 and 312. Information on cost and method of installation will be furnished on request.

Illustrated bulletins complete with detailed specifications for the Type 512 are yours for the asking, but we'd like best for you to see this popular machine *in action, underground.* So many 512's are in service today that we can easily arrange for you to see one near you. Just drop us a line.

Goodman MANUFACTURING COMPANY

HALSTED STREET at 48th • CHICAGO 9, ILLINOIS

CUTTING MACHINES • CONVEYORS • LOADERS • SHUTTLE CARS • LOCOMOTIVES

500,000 MINE CARS CAN'T BE WRONG:

TIMKEN® bearings cut the cost of hauling coal and ore!

IF you want to cut hauling costs you can find one proven answer in the mine cars—more than 500,000 strong—that are equipped with Timken® tapered roller bearings. Successful mine operators report that Timken bearings require less attention, reduce power requirements, cut the cost per ton hauled.

Because they are made from case-hardened Timken fine alloy steel, Timken bearings easily carry the heavy shock loads found in mine car service. The tough inner core of the rollers and races takes the smashing impacts while their hard, smooth surfaces reduce friction and wear to a minimum. Due to their true rolling motion, Timken bearings permit more cars per train to be hauled with no increase in power requirements.

Timken bearings provide maximum load carrying capacity due to the line of contact between rollers and races. Cars take curves easier because the tapered design of Timken bearings takes radial and thrust loads in any combination.

Mine operators get maximum life from the bearings due to the adjustable feature of the Timken bearing mounting. No need for the costly replacement of bearings and parts as a result of wear. If wear should occur, just tighten the nut and the Timken bearings are brought back to their original setting. This feature is found only in mine car wheels equipped with tapered roller bearings.

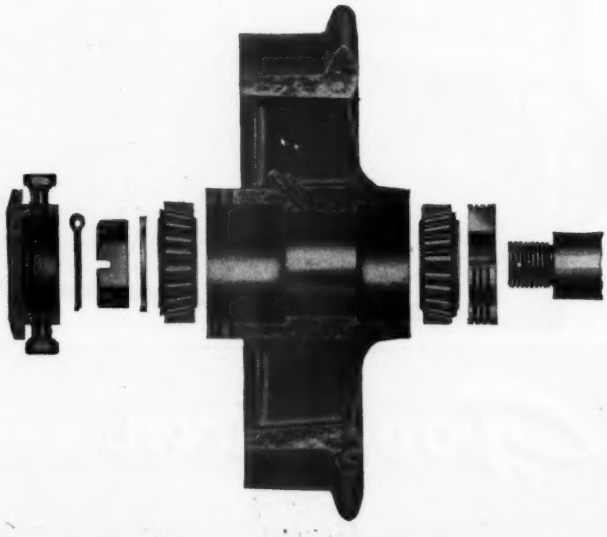
If rising costs are whittling your profit margin, investigate today the way Timken bearings can bring your hauling costs *down.* Write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

CUT YOUR COSTS BY SPECIFYING

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



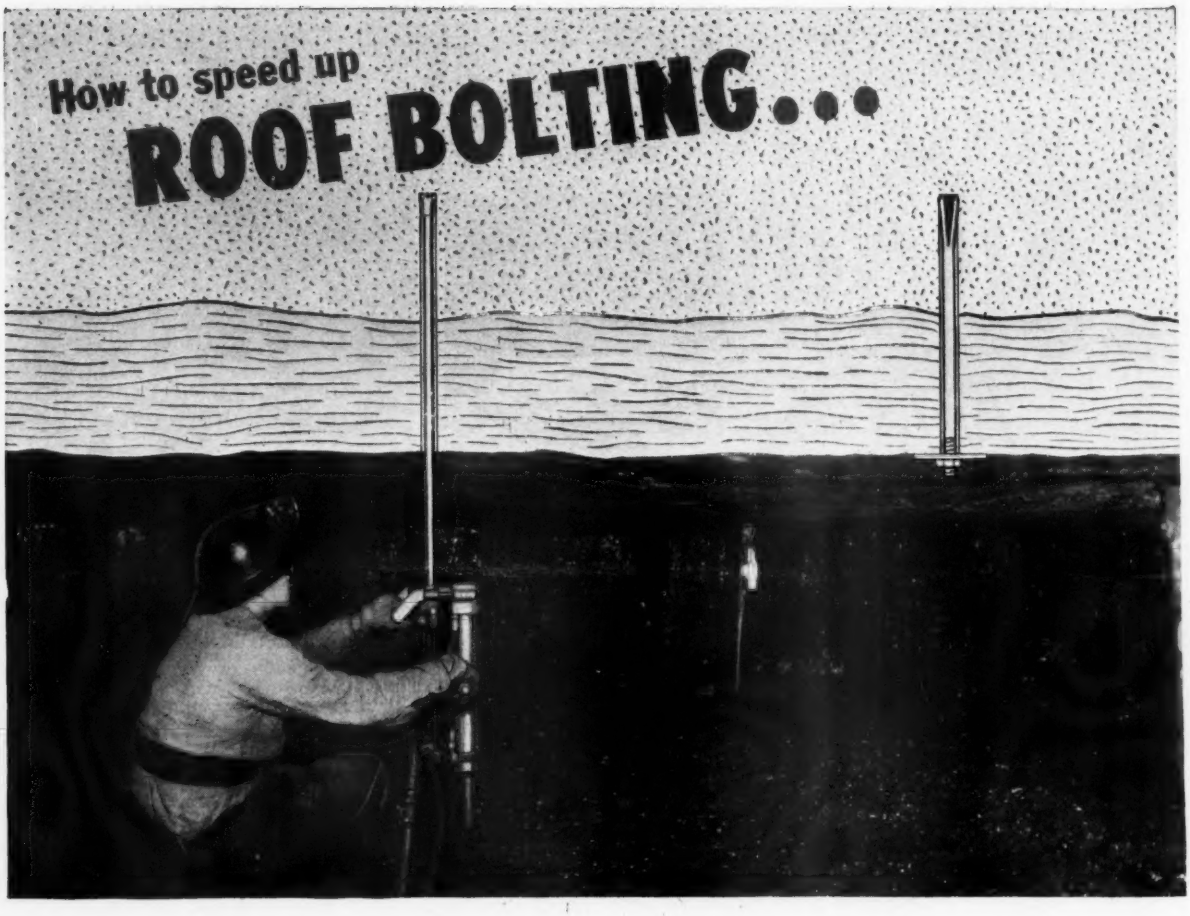
NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

A Modern Pioneer for New Frontiers

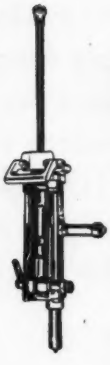
In expanding the coal-stripping frontiers and searching for more economical means of uncovering coal at increasing depths, many mine owners have found the ideal solution in Bucyrus-Erie walking draglines — like the 8 to 10 cubic yard 450-W shown working in a Kentucky mine. The 450-W swings booms 165 to 200 feet long, digs as deep as 130 feet . . . can dump material a maximum 412 feet from digging point. It offers unusual stability, easy accurate control and carefully balanced power for a fast cycle that boosts production. Its simple, reliable walking mechanism carries the 450-W safely, surely over soft, loose or wet ground without destructive jars or shocks, and the entire machine is simply designed and ruggedly built for a lifetime of dependable service with low maintenance costs. We will be happy to supply full information on the 450-W and other walking draglines in the outstanding Bucyrus-Erie line.

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN



... with the popular I-R "Big Three"
ROOF BOLTING COMBINATION



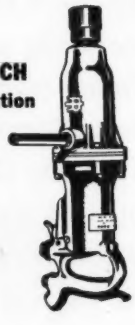
1 RP 38 "SHORT-LEG" STOPER
more power, less weight

Light in weight, well-balanced, this powerful, ultra-compact RP 38 "Short-Leg" Stoper can be readily handled in seams as low as three feet. It provides automatic rotation for fast, easy drilling of roof holes, and has plenty of power for driving roof bolts.

For extra heavy drilling, use Model RP-48.

2 SIZE 534 IMPACT WRENCH
maximum torque, easy operation

Tightening the nuts in roof bolting is done quickly, easily with the I-R 534 Impact Wrench. This air-operated tool exerts a more powerful turning effect than that of any other portable wrench of this size. Extra deep sockets are available.



3 CARSET JACKBITS
faster drilling, longer life

Widely-used, long-lasting Carset Jackbits, with inserts of tungsten carbide, practically eliminate bit changing and the time loss this means. They stay sharp longer. Increase drilling speed 50% or more.

Your nearest I-R representative will gladly give you further information on roof-pinning equipment. Or write Ingersoll-Rand. 11 Broadway, New York 4, N. Y.

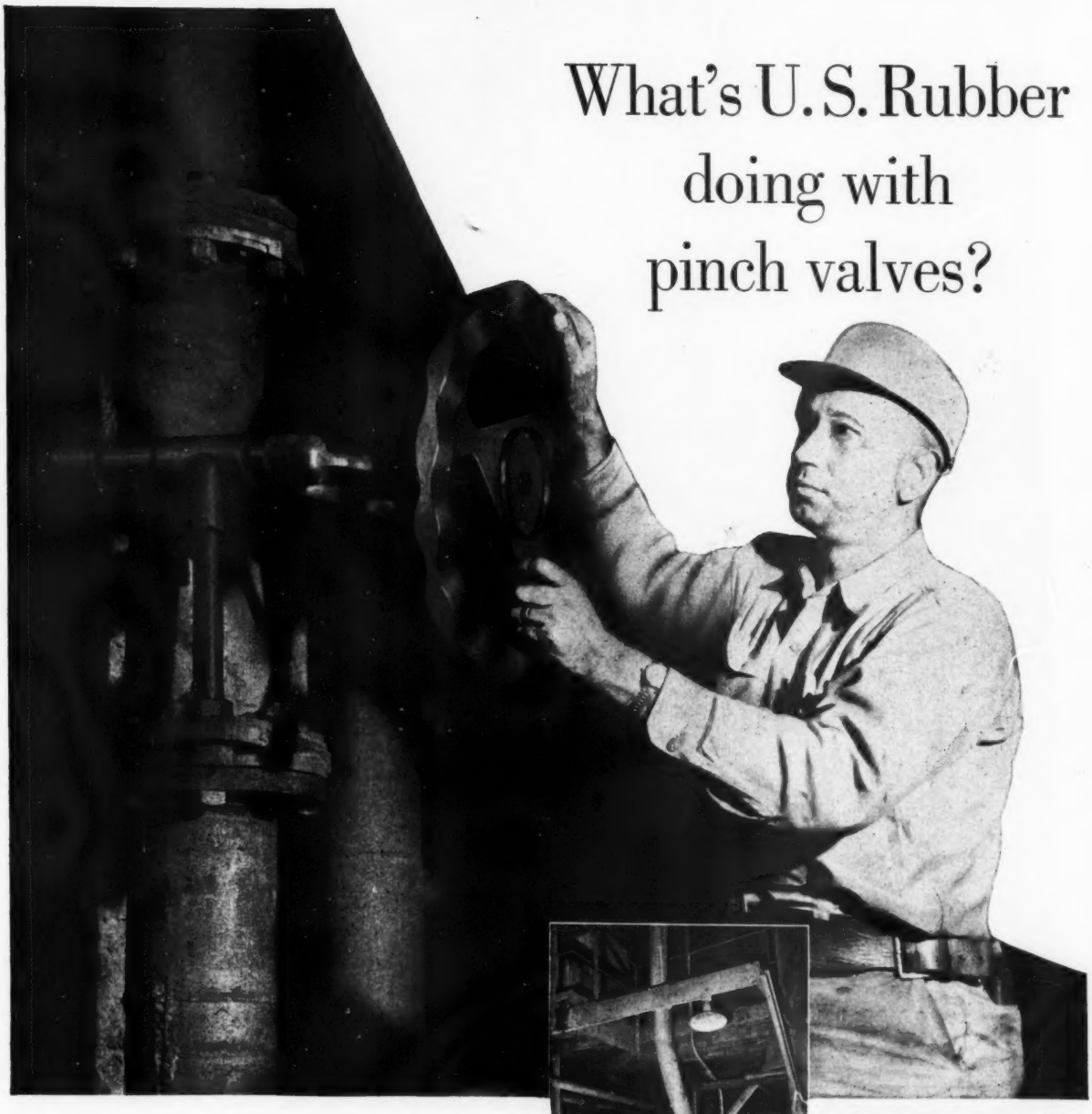
Ingersoll-Rand

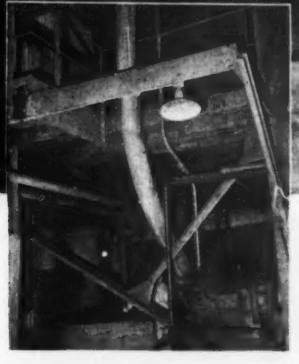
11 Broadway, New York 4, N.Y.

567-5

ROCK DRILLS • COMPRESSORS • AIR TOOLS • TURBO-BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

What's U.S. Rubber doing with pinch valves?





U.S. PILOT PINCH VALVE being adjusted by coal mine superintendent to control flow in preparation plant of large West Virginia mine. Mechanism is very compactly designed, can be refitted to new pinch valve bodies.

U.S. PILOT FLEXIBLE PIPE conveying sand and water in same preparation plant. Pipe is so flexible no elbows or short connections are needed. This particular pipe has been in service two and one half years so far, replacing a metal pipe which lasted only six months.

In many coal preparation plants U.S. Pilot Pinch Valves control the flow of water containing abrasives. In the chemical industry, they handle corrosive mixtures, acids, and solids. They serve the paper industry, the food and beverage industry.

Another "U.S." product invaluable in coal washing is U.S. Pilot Flexible Pipe. The one at right carries up to 10,000 tons of sand a day. Both Pilot Pinch Valves and Flexible Pipe safeguard equipment from mechanical strain caused by vibration, expansion, contraction and "water-hammer."

PRODUCTS OF

U.S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

"Here's how the Leatherwood Plant keeps pace with underground mechanization"

By RICHARD G. MILLER, ROBERTS and SCHAEFER COMPANY

RICHARD G. MILLER

A veteran of 41 years with Roberts and Schaefer Company, Richard G. (Dick) Miller is truly a pioneer in the field of coal preparation. As district manager of the R & S Huntington office, Mr. Miller has practically "lived" with the New Leatherwood Mine preparation plant since it was conceived in 1948 . . . right up to the present time. This is his story of the "whys" and "hows" behind this outstanding plant.

"Since 1945, the Blue Diamond Coal Company has been mining premium domestic coal at their Leatherwood Mine in Kentucky. By 1948 they had found that their over-all operations had become greatly unbalanced—like many other mines, the underground mechanization program had far surpassed its surface preparation facilities.

"In order to correct this condition, a preparation plant was developed, and building begun in 1948 by Roberts and Schaefer Company.

"This followed a period of study and is a modern plant operating to meet both competition and changing customer requirements on a profitable basis.

"Since its completion the plant has come to be regarded as one of the most outstanding of its kind in the United States . . . truly, a design of modern arrangement and utility. All coal to be prepared is delivered to the plant from drifts on opposite sides of a valley via a 750-foot-long trestle having two haulage-ways. Bottom dump cars discharge run-of-mine coal into two 1250-ton storage bins constructed integrally with the trestle.

"The capacity of the Leatherwood Mine has a potential production rate of 2,000,000 tons of clean coal yearly, which is a testimonial to its production capabilities."

Here again, is a typical example of how Roberts and Schaefer Company solves the most exacting of coal preparation problems. As in the case of the Leatherwood Mine, R & S's advanced research methods, engineering know-how and constantly improved handling equipment mean the difference between Profit and Loss.

The broad R & S engineering, construction and manufacturing facilities enable this organization to do the whole job or any part of it . . . to create completely new plants or modernize obsolete structures and methods. The result is always: Producing of Premium Coal at Premium Prices . . . a plant that operates to its owner's complete satisfaction and greatest profit.

One of the finest testimonials any company can receive is the "repeat order." Roberts and Schaefer Company has an impressive record of repeat-contracts due to this one simple reason: R & S-engineered plants do the job they are intended to do. You couldn't ask for more!

Consider your own plant . . is it efficient, economical, is it measuring up to increased competitive pressure? And here's an extremely important question to ask yourself: "Are the benefits of modern mining methods being lost because your plant is obsolete?" If you have the slightest doubt about any of these points—R & S engineers invite you to consult with them.

ROBERTS & SCHAEFER COMPANY

130 North Wells Street, Chicago 6, Illinois
1314 Henry W. Oliver Bldg., Pittsburgh 22, Pa.
254 West 54th Street, New York 19, N. Y.
P. O. Box 570, Huntington 10, W. Va.

JEFFREY
UNDERGROUND CONVEYORS
for Bituminous and Anthracite Mining

● Our Conveyor Engineers are specialists. They do not change around . . . conveyors today, locomotives tomorrow or shuttle cars the next day . . . they concentrate on conveyors. That is their business. They develop, design and build for you.

So you can select a Jeffrey Conveyor, Chain or Belt type, with the utmost confidence that it will meet your requirements for capacity and nature of service. These Engineers know how to provide for low initial investment . . . the greatest efficiency and economy.

Give them a chance to help you.

Jeffrey 61-AM Room Conveyor with power unit mounted at side on leveling base. Maximum length 300 ft.—capacity 1 to 1.5 T.P.M. (Patented)

The view above shows a Jeffrey 61-AM Room Conveyor (Chain Type) going through to and discharging into a Jeffrey gathering conveyor. Also in this illustration you will see a typical installation of a Jeffrey Type 61 Blower. Yes, Jeffrey goes underground in a big way . . . more often than not you'll find two, three or more machines in one mine doing a tremendous job of keeping coal on the move. For Conveyors—send for Catalog No. 820, which tells all.

The Jeffrey Manufacturing Company

(Founded in 1877)

958 North Fourth Street, Columbus 16, Ohio

District Offices

Baltimore 2	Buffalo 2	Denver 2	Jacksonville 2	Pittsburgh 22
Beckley, W. Va.	Chicago 1	Detroit 13	Milwaukee 2	Salt Lake City 1
Birmingham 3	Cincinnati 2	Harlan, Ky.	New York 7	St. Louis 1
Boston 16	Cleveland 15	Houston 2	Philadelphia 3	Scranton 3

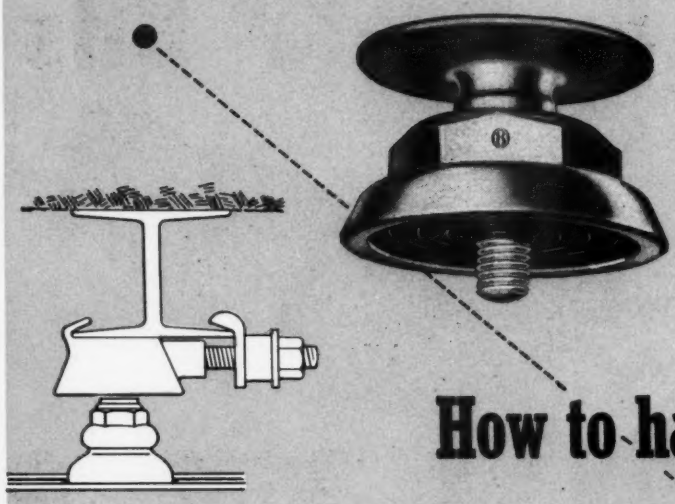
Service Stations

Birmingham — Pittsburgh — Johnstown — Scranton — Mt. Vernon, Ill. — Harlan, Ky.
In West Virginia: Beckley — Cabin Creek — Logan — Morgantown — Welch

Associated Companies

Jeffrey Mfg. Co., Ltd., Montreal, Canada
British Jeffrey-Diamond Ltd., Wakefield, England
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Ohio Malleable Iron Co., Columbus, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio
The Galion Iron Works & Mfg. Co., Galion, Ohio

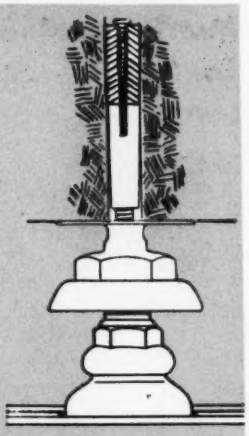
Bin Valves
Bucket Elevators
Car Pullers
Chains
Conveyors
Coolers & Dryers
Coal Cutters
Crushers
Drills
Feeders
Fans & Blowers
Idlers (Belt)
Jigs
Loaders
Locomotives
Magnetic Separators
Pulverizers
Screens
Shuttle Cars
Transmission Mach'ry



ROOF-TYPE HANGERS

The Universal-2 Hanger shown and several like it can be attached directly to the roof, or can be attached to timbers by means of mine hanger screws.

Cat. No. 11907

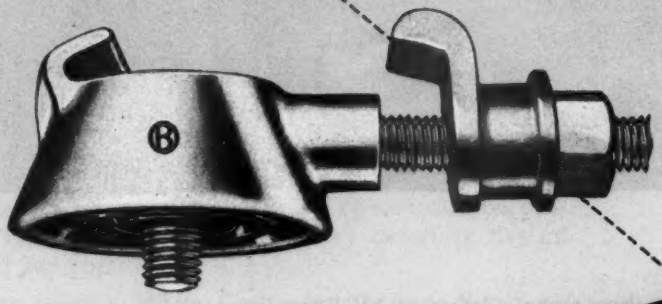


How to hang a Wire—

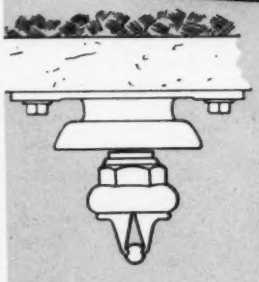
I-BEAM HANGERS

Here's a good way to put a hanger on an I-Beam. The hanger shell is provided with an adjustable clamp which hooks over and tightens onto the flange. O-B Insulated I-Beam Hangers are made for flange widths ranging from 3 inches to 13½ inches.

3 to 5 inch flange..Cat. No. 15391
5 to 8 inch flange..Cat. No. 15803
8 to 13½ in. flange..Cat. No. 20551



anywhere



TIMBER-TYPE HANGERS

A couple of lag screws hold the Type-H hanger onto the timber. Side-mounting hangers for low vein mines and other locations where head room is limited are available also.

Cat. No. 1153

No matter how your mine roof is supported, there's an O-B method for attaching hangers either to the support or, if you wish, to the roof. Some are shown here. For each method there are several O-B hangers or combinations of hangers and accessories, one of which will make hanger attachment a simple matter in your mine.

In the O-B Mining Catalog you will find a wider selection of hangers. From this listing you can select a small group of hangers and accessories for use anywhere throughout your mine. Simplify your trolley installation, and your stock-keeping, with standard O-B hangers.

4099-M

Ohio Brass

MANSFIELD OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Matthews, Moore Coal Co. Supt. reports bit cost of .28 of one cent

Mr. Claude Matthews, superintendent, Moore Coal Co., Devonia, Tenn. reports that heavy-duty Kennametal Bits have saved money on cutting time, machine repair, and bit costs. Seventy-five heavy-duty bits cut 2,400 places. Bit cost was reduced to .28 of one cent. A saving of 29% was made on power which lowered upkeep cost on mining machines.

●

Grinding Folder Available . . . FREE

Kennametal Inc., Latrobe, Pa. has fully-illustrated folder offering complete details on how to PROPERLY and economically keep cemented carbide mining machine bits in top cutting condition. Special features: Step by step instructions on grinding, how to tell when bits are dull, how to avoid bit chipping, and what causes carbide bits to crack.

●

43% decrease in power

Power test developed in a Raleigh County, West Virginia mine shows that Kennametal U-8 (heavy-duty) bits required just 57% as much power as the two different styles of steel bits that were tested. Readings were: Steel Bit Y—.40 KWH per ton, Steel Bit Z—.48 KWH per ton, Kennametal U-8—.25 KWH per ton. Test conditions were identical.

Kennametal Bits

SAVE POWER

—help to lower operating cost

Power Problem

How do Kennametal (X) and steel bits (Y) compare?
Ans.: X = 37 H.P./place
Y = 52 H.P./place
X/Y = 37/52 x 100 = 71% (% power needed by X bit) or X bit uses 29% less power than Y bit.

The problem at the left was solved for Claude Matthews, Supt., Moore Coal Co., Devonia, Tenn., by an engineering company that computed the power requirements of steel bits and Kennametal bits. Results showed that steel bits placed 104% of rated load on the machine motor while Kennametal bits required only 75% of rated load.

Kennametal bits save power because they are tipped with Kennametal cemented carbide. It is a cutting edge material that stays sharp 50 to 200 times as long as steel. That is what makes Kennametal the greatest power saving bit in the coal field.

Some mines save as much as 5 and 6 cents per ton on Kennametal bits. These savings are divided up among the amount of bit changing, reconditioning time, bit cost, and repair cost that are saved. Numerous power tests like this one prove that Kennametal bits save 25 per cent or more on power. And power checks are one of the most definite indexes on savings that it is possible to make.

Let a Kennametal representative give you FREE proof that Kennametal bits can mean big savings to you. He specializes in cutting and drilling —is also a likable man with years of experience in the mines.

Contact him today by writing Kennametal Inc., Latrobe, Pa. A postal card and three words, like "send a representative"— your signature — will do the trick. No obligation!

KENNAMETAL®

DRILL BITS • MACHINE BITS • STRIP BITS • ROCK BITS

Write us for any information you want on Cutting or Drilling

You've heard about our original COCOON—it's the tough, waterproof, acid-proof sprayable plastic that has been used by the Army and Navy to "wrap up" everything from B-29's to battleships.

Now a special version of COCOON—G. E. COCOON, is proving highly useful in mine stopping applications, providing a flexible, continuous seal which can be applied quickly, without special skills. Get the whole COCOON story—write today for details.

HERE'S HOW G. E. COCOON IS USED

- For Temporary Stoppings on Brattice Cloth
- For Dry Walls of Concrete Block
- For Repairs of Cracked Concrete Walls or Broken Overcasts
- For Roof and Ribs to Prevent Spalling
- For Sealing Off Mine Fires

AND HERE ARE SOME OF THE *BIG* ADVANTAGES OF G. E. COCOON

1. More effective sealing makes ventilating systems more efficient—cuts operating costs of fans and pumps.
2. Saves money by facilitating recovery of stopping materials (G. E. COCOON can be reused many times).
3. Is absolutely non-toxic—can be sprayed in confined areas without masks using standard pressure spraying equipment.
4. Acid and moisture-proof; will not mildew or rot.
5. Recommended spraying equipment includes 2-wheel, mobile air compressor. Weight 275 lbs.—L. 26", W. 17", H. 24".

COCOON

Whiz

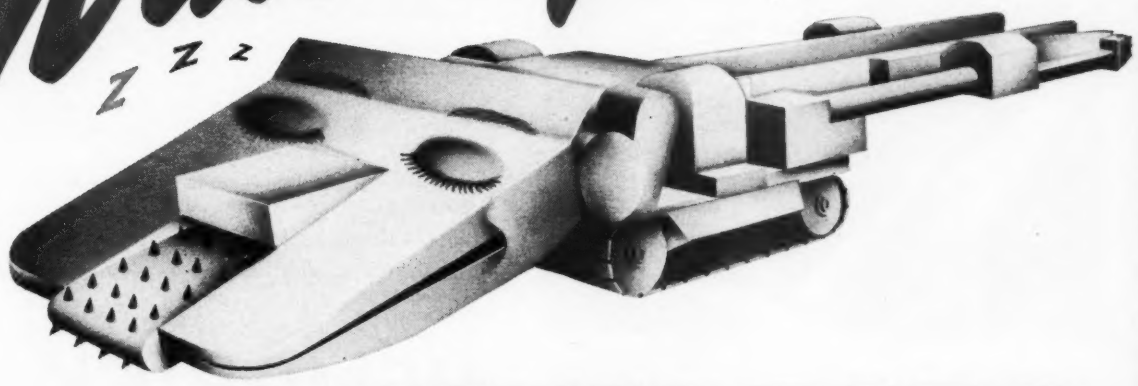
COCOON ENGINEERING DIVISION
R. M. HOLLINGSHEAD CORP.
Camden 2, New Jersey
LEADER IN MAINTENANCE CHEMICALS
Canadian Offices: Toronto
Warehouses: Dallas, San Francisco, Chicago

SEE IT FOR YOURSELF!

Let our engineers recommend a G. E. COCOON application to meet your specific problem. Demonstrations and training courses for your men can be arranged at our Camden offices and, in many instances, at your own mines. Write for information.

NO LOADING MACHINE

Waiting...

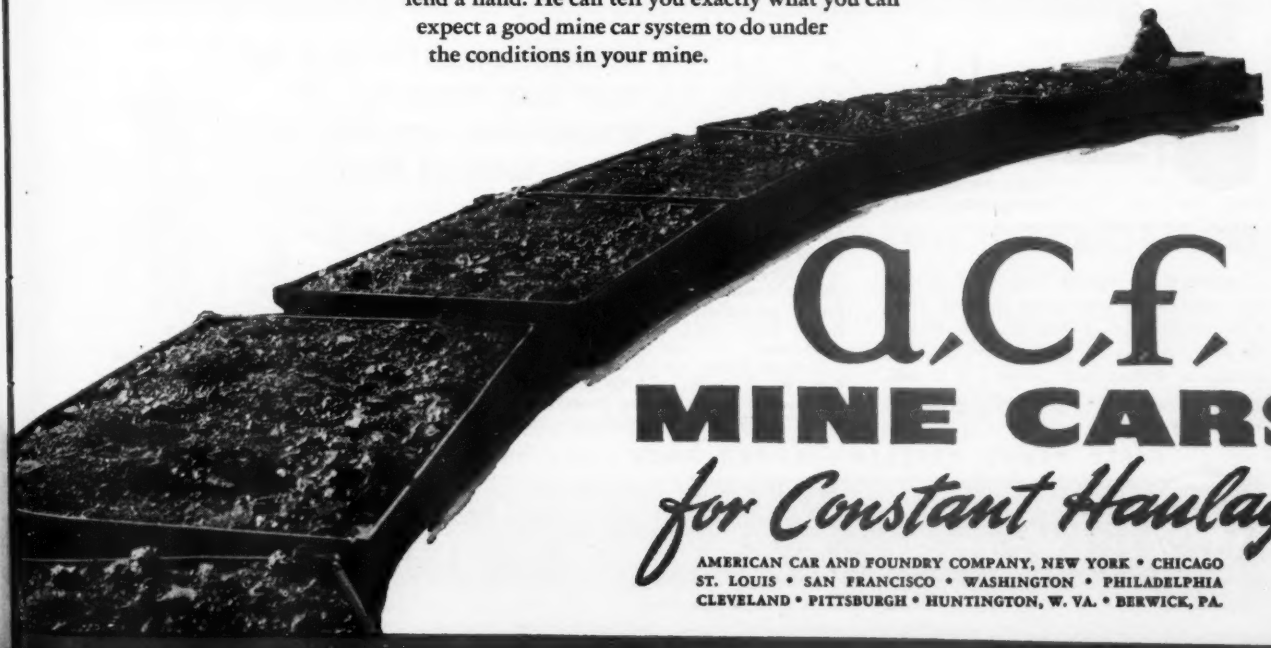


...with MINE CARS

Imagine how much you lose in $$ when big loading machines just sit...and wait. That's the cost of a breakdown in a one-unit haulage system. *That's what a multiple system of constant-haulage mine cars can save you!*

Just look at the one big difference between mine cars and a 'continuous' haulage system: *the time-out costs.* Repairs on mine cars are few, far between, and mostly quite inexpensive. Even more important—one car 'out' *doesn't stop your coal from moving!* If a car needs adjustment...onto a siding with it! Your loaders fill up the rest of the trip. Your men—all the way from the face to the tipple—keep normally busy. Your coal gets out *all* day...*every* day...when you use a complete mine car system. You *keep* the loading machines busy!

Next time you plan for modern haulage, let your nearby a.c.f. representative lend a hand. He can tell you exactly what you can expect a good mine car system to do under the conditions in your mine.



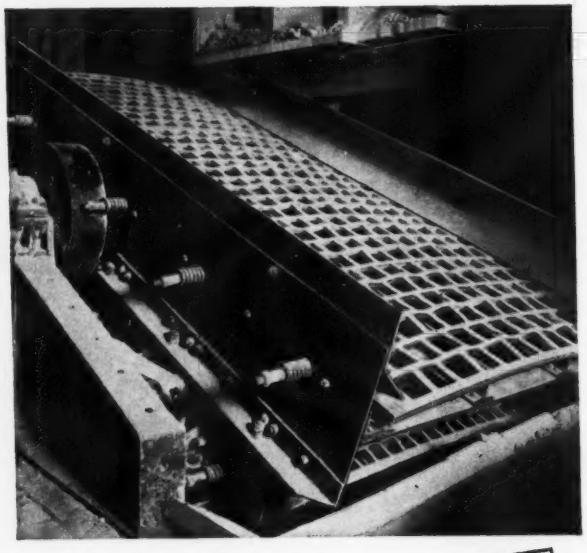
a.c.f.

MINE CARS

for Constant Haulage

AMERICAN CAR AND FOUNDRY COMPANY, NEW YORK • CHICAGO
ST. LOUIS • SAN FRANCISCO • WASHINGTON • PHILADELPHIA
CLEVELAND • PITTSBURGH • HUNTINGTON, W. VA. • BERWICK, PA.

Outstanding Advantages of Hendrick Perforated Plate



for vibrating

and . . .

shaking screens

- It maintains uniformity of mesh throughout an unusually long service life.
- It can be supplied with any desired shape and size of perforations.
- It can be made—either flat or corrugated—in any required gauge in tank, high carbon, high tensile, and abrasive-resisting steels.
- For screening highly abrasive materials, it is heat-treated to increase its toughness.
- Its full clearance practically obviates clogging.
- The ease with which decks can be changed cuts labor costs.

Write for copy of Hendrick Perforated Plate Catalogue

SEE OUR CATALOG IN SWEET'S

HENDRICK

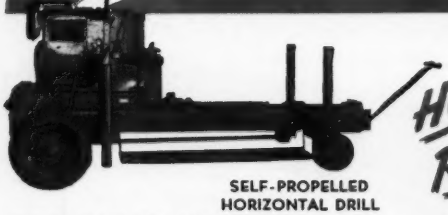
Manufacturing Company

62 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

McCarthy Drills PAY OFF!



SELF-PROPELLED HORIZONTAL DRILL

FOR BLAST HOLE DRILLING

●Heavy all welded steel carriage and four individually adjustable leveling jacks make setups faster, drilling smoother. Finger-tip hydraulic control permits instantaneous change of drilling feed. Bores 5 to 10-inch diameter blast holes to horizontal depths of 120 ft. or more.

Heavy-Rugged

✓ McCARTHY DRILLS PAY THEIR WAY
✓ MAKE MORE MONEY FOR YOU
✓ RECORDS SHOW 40% MORE HOLES
✓ LIST OF USERS ON REQUEST

●McCarthy Vertical Drills adapt to any job where ordinary rock formations are to be blasted.

Designed with compact retractable hydraulic tower for Truck, "Cat," Half-track or Jumbo mountings. Power shafts made of tough alloy steel. Simplified construction throughout.

Over-all height with tower reclining: 7 ft., 4 in. Wt.: 5,100 lbs. All McCarthy units can be operated with Gasoline, Diesel or Electric power units. Write for descriptive literature.

Powerful

VERTICAL DRILL

FIFTY YEARS DRILLING EXPERIENCE 1901-1951

SALEM

MANUFACTURED BY

THE SALEM TOOL COMPANY

770 SOUTH ELLSWORTH AVE. — SALEM, OHIO, U. S. A.

SALEM

Coal washer gets clean bill of health with . . .

AT A LARGE midwest mine, operators tried a conventional grease on the air valves of a coal washer. These valves control air flow used to agitate and separate coal from refuse. The grease did not seal the control valves against air leakage. Resulting loss of pressure threw air pulsations off beat, caused uneven operation and poor separation of refuse from the coal. Grease consumption ran high.

The washer was switched to a SUPERLA Grease recommended by a Standard Oil lubrication specialist. *This lubricant took the job in stride.* It prevented air leakage, kept bearing surfaces well lubricated. Throughout nine years of service it has kept valves in top working order and in excellent condition. Efficient separation of refuse from the coal has been the result.

A lot of tough lubricating jobs in your mine can be turned over to SUPERLA Greases. They will give you results comparable to what you can get with the highest type of special greases. They will prove as readily available and economical as ordinary cup greases.

SUPERLA
REG. U. S. PAT. OFF.
Greases

Discuss the advantages of SUPERLA Grease with a Standard Oil lubrication specialist. His headquarters are near your mine. How you can benefit from his services is explained at the right. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

J. A. Grieve, lubrication specialist at Standard Oil's Decatur office, helped this midwest mine make important savings with SUPERLA Grease. He was close at hand, gave operators engineering service when they needed it.

There's a corps of Standard Oil lubrication specialists throughout the Midwest. You'll find one located near your mine. Through special training and a lot of practical experience, this man has gained a working knowledge of lubrication that can mean real savings for you. To obtain his services, simply contact the nearest Standard Oil (Indiana) office. Discuss with him the savings you can make with such outstanding products as:

STANOIL Industrial Oils—Here's *one* line of oils that provides cleaner operation of loader and crane hydraulic units; supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

SUPERLA Mine Lubricants—These new, improved oils and greases provide better lubrication of cutters, loaders, locomotives, mine cars, and other underground equipment. They eliminate transmission-case deposits, reduce clutch-plate gumming, and minimize wear on gears and bearings.

CALUMET Viscous Lubricants—On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears and better internal lubrication of wire rope.

STANDARD OIL COMPANY (INDIANA) STANDARD

MACKS make light of heavy loads . . .

Big Mack super-duty trucks make the hard jobs look easy... because in design and construction they incorporate numerous outstanding features that contribute to easy maneuverability, ease of control and positive traction regardless of terrain.

Powerful Diesel Engines! Hydraulic Power Steering! Air Assist Clutch! Flexible Rubber Shock Insulators! Mack's famed Balanced Bogie and Power Divider. All are Mack features that assure power and strength for the heaviest loads; flotation and traction for the most slippery mud or sand.

Your nearest Mack branch or distributor will give you the full story on what Macks can do for you in trouble-free, uninterrupted schedules... greater profits through greater output at lower cost. You'll find it's a story well worth hearing.

Only Mack gives you all the advantages of the famed Balanced Bogie. Positive traction because of exclusive Power Divider. No spring twist because of Mack Rubber Shock Insulators. Inherent flexibility eliminates chassis distortion. Extended tire life because of uniform tire loading. Minimum maintenance because of simplicity of design.

Mack TRUCKS

...outlast them all

Mack Trucks, Empire State Bldg., New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

Photograph by Barton Murray

Take a look at tomorrow's highway

There's a great new era ahead in highway construction. You can see it in the famous Pennsylvania Turnpike, now being extended eastward to the outskirts of Philadelphia, westward to the Ohio border.

This modern "thru-way", a pioneer triumph of engineering for transportation safety, speed, comfort and convenience, stretches for 260 miles without a single stop light, crossing, sharp turn or noticeable grade. It is the nucleus of a vast super-highway transportation system that one day may link every section of the country.

Cyanamid blasting materials and the cooperation of Cyanamid explosives engineers have helped to telescope the work of years into months in moving "mountains" of earth and rock to make way for this huge project. Supplying explosives and assistance in their use for mining, quarrying and other purposes, as well as construction, is another of many Cyanamid services that are helping America build for the future.

AMERICAN *Cyanamid* COMPANY

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Materials for the explosives-using industries—Another of the services performed by Cyanamid

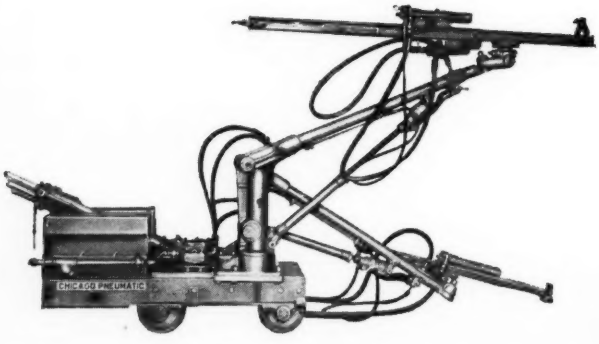
FOR HIGH-SPEED TUNNEL DRIVING

The new G-600 Air Actuated Drill Jumbo provides maximum speed and efficiency for tunnel driving. Rail-mounted, it is built for all standard track gauges, in single or multiple-boom units.

Outstanding Operating Features

- **Booms are quickly adjustable to any drilling position.**
- **Vertical adjustments are made by rotary air actuating motor.**
- **Automatic safety locks prevent boom arms from settling.**
- **Control valve of actuator motor is conveniently located at end of boom arm.**
- **Dual valve handles permit operation from either side of boom.**
- **Unit is readily disassembled and assembled. Component parts are of sizes easily handled on mine cages.**

For complete specifications write for copy of SP-3026



Twin-boom unit with two typical drill mountings for mine headings up to 10′ x 12′. Upper arm has 6-foot chain type feed mounting. Lower arm has 4-foot shell type feed mounting.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

JOB PROVED...

10-Ton "EUC"

Emerging from a tunnel which leads to an underground loading area, this Model UD starts up the haul road to the crushing plant at C. A. Langford Stone Company in Tennessee.

The Acme Construction Company uses this 10-Ton Rear-Dump on a highway construction job at Matoaka, W. Va. The "Euc" is loaded with earth and shale by a 1¼ cu. yd. shovel.

Powered by a 125 h.p. diesel engine, the Model UD has a top speed of 35.7 m.p.h. and plenty of power for steep grades. The 860' haul road at the C. A. Langford quarry near Cookeville, Tenn., has a maximum grade of 10%.

High dumping angle and fast-acting Euclid hoist assure quick dumping. Here the "Euc" dumps a capacity load of limestone into crusher at the H. & R. Stone Company quarry at Ridgeville, Ind.

Built for jobs requiring a smaller capacity hauling unit for heavy off-the-highway service, the 10-Ton Rear-Dump Euclid has made good ... hauling more tons at less cost in mines, quarries, construction and industrial work. Owners like the Model UD because it is easy to handle ... has ample power and speed ... and can do a wide range of jobs economically.

You can depend on the 10-Ton Euclid for greater job profits and long service life. Your Euclid distributor will be glad to discuss your job requirements ... write or call him today for information on the Model UD Rear-Dump or the complete line of Euclid earth moving equipment.

THE EUCLID ROAD MACHINERY CO.
CLEVELAND 17, OHIO

EUCLIDS

CARDOX

NON-EXPLOSIVE MINING METHODS

THESE 208 OPERATORS *Are Now Using*

EITHER CARDOX OR AIRDOX MINING METHODS

WEST VIRGINIA

Algoma Coal and Coke Company (3)
American Coal Company (2)
Ames Mining Company (2)
Brule Smokeless Coal Company
Carbon Fuel Company
Clear Creek Coal Company (2)
Crozer Coal and Coke Company
I. W. Davis Coal Company
Delmont Fuel Company (4)
Eastern Gas & Fuel Associates
Eleanor Coal Company
Elk Lick Coal Company
Gay Mining Company (2)
Dorothy Gordon Coal Company
Gulf Mining Company
Harris Coal Company
Hoylman Coal Company
Hutchinson Coal Company
Island Creek Coal Company (2)
Imperial Smokeless Coal Company
J. Jarrell
Johnstown Coal & Coke Company (4)
Koppers Coal Division
Lamar Collieries Company
F. M. A. Leach
Leckie Smokeless Coal Company
Lorado Coal Mining Company
Mariana Smokeless Coal Company
National Mines Corporation (3)
New River Company
Nicholas Webster Coal Corporation
Nicholas Webster Lumber Company (4)
Pardee and Curtin Lumber Company
Pecks Run Coal Company
Peters Creek Coal Company
Premier Pocahontas Collieries
Princess Dorothy Coal Company
Raine Lumber and Coal Company
Raleigh-Wyoming Mining Company (4)
Red Jacket Coal Company
Red Parrot Coal Company
Richwood Sewell Coal Company
Ridgeview Coal Company
Rupert Smokeless Coal Company
Sycamore Coal Company
Tioga Coal Corporation (3)
Truax-Traer Coal Company
United Pocahontas Coal Company (3)
Warner Collieries
Webb Coal Mining Company
West Gulf Collieries
Weyanoke Coal and Coke Company
Winding Gulf Collieries
Wood Coal Company

VIRGINIA

Blackwood Fuel Company, Inc. (2)
Clinchfield Coal Corporation (2)
Coal Processing Corporation
Jewell Ridge Coal Corporation
King Cole Mining Corporation
Page Pocahontas Coal Corporation (2)
Sycamore Coal Corporation

KENTUCKY

Bell & Zeller Coal & Mining Company (2)
Bell Coal Company
Big Jim Coal Company
Black Star Coal Corporation
Blue Bird Mining Company (2)
Blue Diamond Coal Company
Cinderella Coal Corporation
Columbus Mining Company (2)
Correale Coal Mining Corporation
Creech Coal Company
W. G. Duncan Coal Company, Inc.
Eblen Coal Company
Elkhorn Coal Company
Elkhorn Jellico Coal Company (2)
Fourseam Coal Corporation
Jewell Ridge Coal Corporation
Kentland Elkhorn Coal Company
Kentucky Collieries Company
Kentucky Ridge Coal Company
Knott Coal Corporation
Marlowe Coal Company
Mary Gail Coal Company
New Big Creek Mining Company (The) (2)
Norton Coal Corporation
Smith Coal Company
Stephens Elkhorn Fuel Company
Stoker Coal Company
West Kentucky Coal Company

TENNESSEE

Straight Fork Coal Company

PENNSYLVANIA

Adamsburg Coal Company
The Berwind-White Coal Mining Company
Butler Consolidated Coal Company
Cambria Clearfield Mining Company
Charles E. Campbell
Culmerville Coal Company
Delmont Fuel Company
Evans Coal Company
Ebensburg Coal Company (2)
Johnstown Coal & Coke Company
Marco Coal Company
Penn Valley Mining Co. Inc.
Pittsburgh Coal Company
Pittsburgh Consolidation Coal Company
Republic Steel Company
S. & U. Coal Company
J. L. Sager Coal Company
Springfield Coal Corporation
Wallwork Coal Company
Westmoreland Coal Company

CARDOX CORPORATION

ANNUAL *Roll Call*

OHIO

The Farm Bureau Cooperative Association Inc.
Gem Coal Company
Hanna Coal Company of Ohio.....(2)
The Hocking Valley Mining Company
Lorain Coal & Dock Company.....(2)
The David Z. Norton Company
Pittsburgh Plate Glass Company
Rail & River Coal Company.....(3)
Warner Collieries Company

ILLINOIS

Bell & Zoller Coal & Mining Company.....(3)
Blue Bird Coal Company.....(2)
Carmac Coal Company
Chicago, Wilmington & Franklin Coal Co....(3)
The Consolidated Coal Company.....(3)
Cutler Coal Company
Dering Coal Company
Franklin County Coal Corporation
Freeman Coal Mining Corporation
Mid-Continent Coal Corporation
Moffat Coal Company
Edward Mohn & Son
Old Ben Coal Corporation.....(5)
Peabody Coal Company.....(6)
Perry Coal Company
Pschirrer & Sons Coal Company.....(3)
Sahara Coal Company
Schull-Moake Coal Corporation
Truax-Traer Coal Company
Union Colliery Company
Wilkins Coal Company

INDIANA

Enoco Collieries Company
Glendora Coal Company
Ingle Coal Corporation
Knox Consolidated Coal Corporation
Linton Summitt Coal Company
Pandora Coal Corporation
Princeton Mining Company
Pyramid Coal Corporation
Rudolph Oil and Coal Company.....(2)
Snow Hill Coal Corporation
Standard Coal Company
Templeton Coal Company.....(2)
Viking Coal Corporation.....(2)
Wolf-Koenig Corporation

OKLAHOMA

Buck Creek Mining Company
Davis & Swindle
Premium Smokeless Coal Company
Reliance Smokeless Coal Company

COLORADO

Bear Coal Company
Black Diamond Fuel Company
Boulder Valley Coal Company
Calumet Fuel Company.....(2)
Canon Black Diamond Coal Company
Canon Monarch Coal Company.....(2)
Canon National Coal Company
Centennial Coal Company
Chandler Coal Company
Clayton Coal Company.....(2)
Colorado Fuel & Iron Corporation.....(3)
Colowyo Coal Company
Consolidated Coal & Coke Company
W. D. Corley, Jr.
Cribbs-Goodman Coal Company
Domestic Coal Company
Double Dick Coal Company
Dry Creek Coal Company
Graden Coal Company
Griffith Coal Mining Company.....(2)
Imperial Coal Company
Juanita Coal & Coke Company
Keystone Coal Company
Liley & Merlino
Louisville Lafayette Coal Company
McNeil Coal Corporation
William E. Russell Coal Company
Tomahawk Coal Company
Victor-American Fuel Company
Western Colorado Coal Company

MONTANA

Bair-Collins Coal Company
Brophy Coal Company
Jeffries Coal Company
Johnson Coal Company
Northern Coal Company
Sheridan-Wyoming Coal Company
Western Coal Company

WYOMING

Burnell Coal Company
Sheridan-Wyoming Coal Company.....(2)
Storm King Coal Company

UTAH

American Gilsonite Company
Peerless Sales Company
Hi-Heat Coal Company

NEW MEXICO

St. Louis, Rocky Mountain & Pacific Co.....(2)

ARKANSAS

Smokeless Coal Company

CANADA

Century Coal Limited
Lethbridge Collieries, Limited.....(2)
The Monarch Coal Mining Company, Limited
Red Deer Valley Coal Company, Limited
West Canadian Collieries, Ltd.....(2)

MEXICO

American Smelting & Refining Company

CARDOX
HARDSOCG
DRILLING EQUIPMENT
Complete line of drilling equipment designed to give you the maximum in drilling efficiency.

• BELL BUILDING • CHICAGO 1, ILLINOIS •

Mining CONGRESS JOURNAL

Published for the Entire Mining Industry
by the American Mining Congress
JOHN C. FOX, Editor

FEBRUARY

VOLUME 37 1951 NUMBER 2

Don't Kill the Goose

IN this Annual Review important phases of mining are analyzed by leading members of the mining profession. They have set down their own views on the accomplishments of the past year and some have ventured to project the curves of present and past trends to predict the future. Such prophesies must always be predicated on a number of "ifs." Were man able to foresee the future many costly mistakes might be avoided.

There is one prediction, however, which can be made with complete certainty. The mining industry will bend every effort to meet the challenge before it today by expanding the production of metals, fuels and industrial minerals as needed in the emergency.

A foretaste of what will be done is implicit in what has been done during 1950. The total value of all mineral production in the United States in the past year rose to $11.7 billion. This figure is almost 11 percent higher than that of the previous year although still not up to the $12.3 billion of 1948.

The increase in value is not all due to across-the-board price rises. The physical volume of all minerals produced rose 10 percent and was only four percent less than the all-time peak of 1948. Bituminous coal output reached 506,000,000 tons, a gain of 68,000,000 tons or 16 percent above 1949. The increase is attributed to fewer work stoppages although short work-weeks held production down during the first quarter. Anthracite output was 44,400,000 tons, a 1,700,000-ton gain. Fuels, including petroleum, etc., accounted for three-fourths of the total value of all the minerals produced.

Other nonmetallic minerals accounted for an estimated $1.7 billion of the total, and output showed an increase of six percent. Nearly all classes, such as construction materials, plant foods, chemical raw materials, sulphur and barite, set new records.

Output of most metals was greater than in 1949. Mercury was the only one which did not increase while tungsten production led all the rest with a 60 percent jump. Copper, gold, molybdenum, silver and titanium concentrates all showed 20-25 percent gains. Iron ore shipments were up 16 percent. Lead and zinc output was four percent above 1949. The total value of all metals produced was $1.3 billion compared to $1.1 billion in 1949.

This record of increased production is a fine example of what free men can do under a system of free enterprise. Let's keep that system. A first step in that direction should be drastic cuts in all Government spending. The state's only income source arises in its taxing power. Therefore, the more expenses it has, the greater the taxes it must levy to meet its commitments. Under the system of private ownership of industry and farms, the owners can operate only so long as they produce more than they consume. If Government, to keep up or increase its spending, demands an ever larger share of production, eventually the point will be reached where there is no margin left between the production and consumption of industry. Private ownership will cease and there will be no more golden eggs.

Kudos to Coal

AMERICA'S coal mining industry has just established the lowest accident rate per million tons mined in its statistical history according to James Boyd, director of the U. S. Bureau of Mines.

Combined figures for both bituminous and anthracite mines show that the total for all injuries—and this includes fatal as well as non-fatal accidents—was 69.93 per million tons of coal mined. This is a 12 percent improvement over the previous record year, 1949.

Another mark set was that for the longest disaster-free period in coal mining history. From November 1948 to January 1951 no major disaster occurred. A major disaster is one in which five or more lives are lost.

A record such as this merits highest praise. The mining industry salutes the men whose unceasing efforts resulted in this outstanding achievement. But a record like this is also a challenge to every member of the mining fraternity. Each one should feel it his bounden duty to see that the record in 1951 is better than that of the past year.

If further incentive is needed, the figures on the other side of the 1950 ledger show that there were 637 miners who lost their lives in coal mine accidents while 37,850 more were injured. These figures represent hardships and heartaches for bereaved families and pain and suffering for those injured. They also represent loss to the national economy, in this time of emergency, of sorely needed fuel for power and heating, coke for steel making and chemical by-products for the defense effort.

For the best safety record in history and for the better record to be set in 1951, kudos to the coal mining industry.

The Authors

Our sincere appreciation to these men whose splendid cooperation has made possible this review of mining's achievements in 1950. On pages 36 to 107 they chronicle the miracle of modern mining. Here is inspiration for greater accomplishment in the critical period ahead.

• JAMES L. HAMILTON, vice-president of Island Creek Coal Co., has contributed the article on modern mechanical coal mining on page 36.

• VINTON H. CLARKE drew upon his 20 years of experience to write the article on metal mining practice. In 1931 he was placer mining near Barkerville, B. C. He attended the U. of Washington from 1933 to 1937 and concurrently garnered experience in the Coeur d'Alenes, Alaska and Washington. He spent nine years at the Chelan Div., Howe Sound Co., advancing from miner to chief engineer. In 1946 he was transferred to New York and in 1950 was made executive mining engineer of the company. His review appears on page 40.

• R. L. LLEWELLYN is preparation engineer for Eastern Gas and Fuel Associates. He is a native of Pittsburgh and started his career in the engineering department of the Pittsburgh Coal Washer Co. After graduation from Penn State he worked for the Koppers Co., Island Creek Coal Co., Valley Camp Coal Co., and joined his present company in 1946. Llewellyn is the second generation of his family associated with coal preparation. He has contributed the fine article on page 43.

• STRATHMORE R. B. COOKE came to North America from the University of New Zealand with wide experience in gold milling and iron and steel metallurgy gained in the Antipodes. He engaged in graduate study at the Missouri School of Mines and Carnegie Institute of Technology. He taught mineral dressing at Rolla and the Montana School of Mines. At present Professor of Metallurgy and Mineral Dressing at the School of Mines, U. of Minn., he is in intimate contact with the latest developments about which he writes on page 47.

• CHAS. H. WINSHIP, JR., is sales manager for the Phelps Dodge Corp. and Phelps Dodge Refining Corp., and a Navy veteran of both World War I and II. He is a graduate of the Telluride School, Deep Springs, Calif., and Cornell University, and joined the Phelps Dodge organization in 1946. He brings a wealth of experience gained through the years to the writing of the Annual Review article on copper on page 50.

• GLOYD M. WILES is manager of the Mining Department of the National Lead Co. From this vantage point, backed by more than a quarter of a century of mining experience, his opinions on the lead industry gain undeniable authority. He has contributed the review of lead on page 51.

• RENE J. MECHIN is a graduate of the Colorado School of Mines. He worked in Mexico for Cia. de Santa Gertrudis. Recrossing the border, he entered the engineering department of St. Joseph Lead Co., Riverside, Mo. In 1926 he was transferred to Edwards, N. Y., served as division manager of the Edwards-Balmat properties almost 23 years and has been in the New York office since 1949. His long association with "St. Joe" has stood him in good stead in the preparation of the article on zinc on page 53.

• WM. S. CUMINGS, technical assistant, mining division, Bethlehem Steel Co., joined the geology department of that company in 1940. He had worked also for the New Jersey Zinc Co. in New Jersey and Pickands Mather & Co. on the Minnesota Iron Ranges.

From the geology department of the Bethlehem Steel Co. he was transferred to the mining department and worked in Chile and Cuba. His experience has given him the insight for the review article on iron ore on page 59.

• JOHN W. IGOE is technical editor for Bituminous Coal Research, Inc., and is in charge of that organization's technical publications and information service, with a broad background of previous experience in technical writing.

HAROLD J. ROSE is vice-president and director of research for BCR and a member of USBM Advisory group on Synthetic Liquid Fuels. Before joining BCR in 1944 he was vice-president in charge of research of Anthracite Industries, Inc., and prior to that was assistant director of research for The Koppers Co. Holder of the Grasselli Gold Medal of the Society of Chemical Industry, Dr. Rose is the author of numerous papers on solid fuel investigations here and abroad.

Collaboration of these two has produced the informative article on bituminous coal research found on page 55.

• WILLIAM L. BURT is author of the article on strip mining of coal. He entered the stripping industry in 1933 with the Jefferson Co. in Ohio and served with that company until 1945. During this period he served as one of the directors of the Ohio Coal Association and during World War II advised the British Government on personnel for strip mining. He has been president of the Greenland Coal Corp. since 1942 and in 1938 founded the Ohio Reclamation Association. His review of the strip mining industry is on page 62.

• JOSEPH L. GILLSON, geologist for E. I. du Pont de Nemours & Co., Inc., has had a long and interesting career. Recently he was engaged in investigation of geological problems connected with choice of a plant site for manufacture of the H-bomb. Currently his assignment is to find sources for aggregate to be used in construction of the plant. His analysis of the industrial minerals situation on page 64 is timely and interesting.

• C. M. DODSON is the fifth president of Weston Dodson & Co., Inc., miners and shippers of anthracite and bituminous coals since 1857. He is also president and director of the Locust Coal Co. and Silver Brook Coal Co. Dodson served in the Naval Air Service from 1942 to 1945. Long experience in the anthracite industry (since 1931) has placed him in a position to speak with authority on its many facets. His interesting review article is on page 67.

• DAVID D. BAKER graduated from University of Arizona and gained his early experience in Arizona and Mexico. Before joining U. S. Vanadium Corp. in 1939 he was superintendent of several California mining operations. He served U. S. Vanadium in various posts, including assistant to the vice-president and manager of tungsten operations. He is now a private consultant. His article on strategic metals is on page 69.

• PAUL R. PAULICK is a graduate of Carnegie Institute of Technology and has 30 years of experience as practical miner, engineer and consultant in coal mining in the United States, Canada, China and Japan to his credit. With a background such as this he is uniquely fitted to contribute the article on underground haulage in coal mines to be found on page 71.

• G. F. COOPE, president of the Potash Co. of America, received his EM degree from Columbia in 1916. Since then he has had wide experience in the mining of copper, nitrate and potash in both North and South America. He joined his present company in 1946 and has prepared the review on potash which appears on page 74.

• GEORGE A. LAMB (left) and JACK L. ZIERCHER are respectively manager, Business Surveys and Business Analyst for Pittsburgh Consolidation Coal Co. Lamb was formerly Asst. Director USBM and a wartime official of the Solid Fuels Administration. He is now on loan to the Government as a consultant on solid fuels to ESA.

Ziercher was graduated from the University of Missouri, and came to the company in 1949 after the Army and Harvard Business School. Their article on Bituminous Coal appears on page 81.

• R. KIRBY SHIRLEY, executive vice-president of the Freeport Sulphur Co., is a native Texan who joined the company in 1922. Since then he has been successively auditor, assistant general manager, assistant vice-president and controller, treasurer, vice-president and treasurer and finally executive vice-president. In his 28 years with the company he has gained the broad knowledge of the sulphur industry which is reflected in his review on page 84.

• Staff members of the U. S. Atomic Energy Commission have joined to contribute the article on the raw materials program, which highlights latest developments in that field. This important review of our position as regards sources of fissionable materials is on page 86.

• Dr. AUREAL T. CROSS, coal geologist-paleobotanist of the W. Va. Geological Survey and W. Va. University, and Dr. PAUL H. PRICE, State Geologist, West Virginia Geological Survey, produced the review of roof bolting developments on page 90.

• F. S. TURNEAURE, associate professor in economic geology at the University of Michigan, has served as chief geologist and examining engineer for Patino Mines in Bolivia, geologist for Oliver Iron Mining Co., and consulting geologist for Mauricio Hochschild, S.A.M.I. He holds a Ph.D. in geology from Harvard University. He has contributed the comprehensive article on mining geology and exploration on page 93.

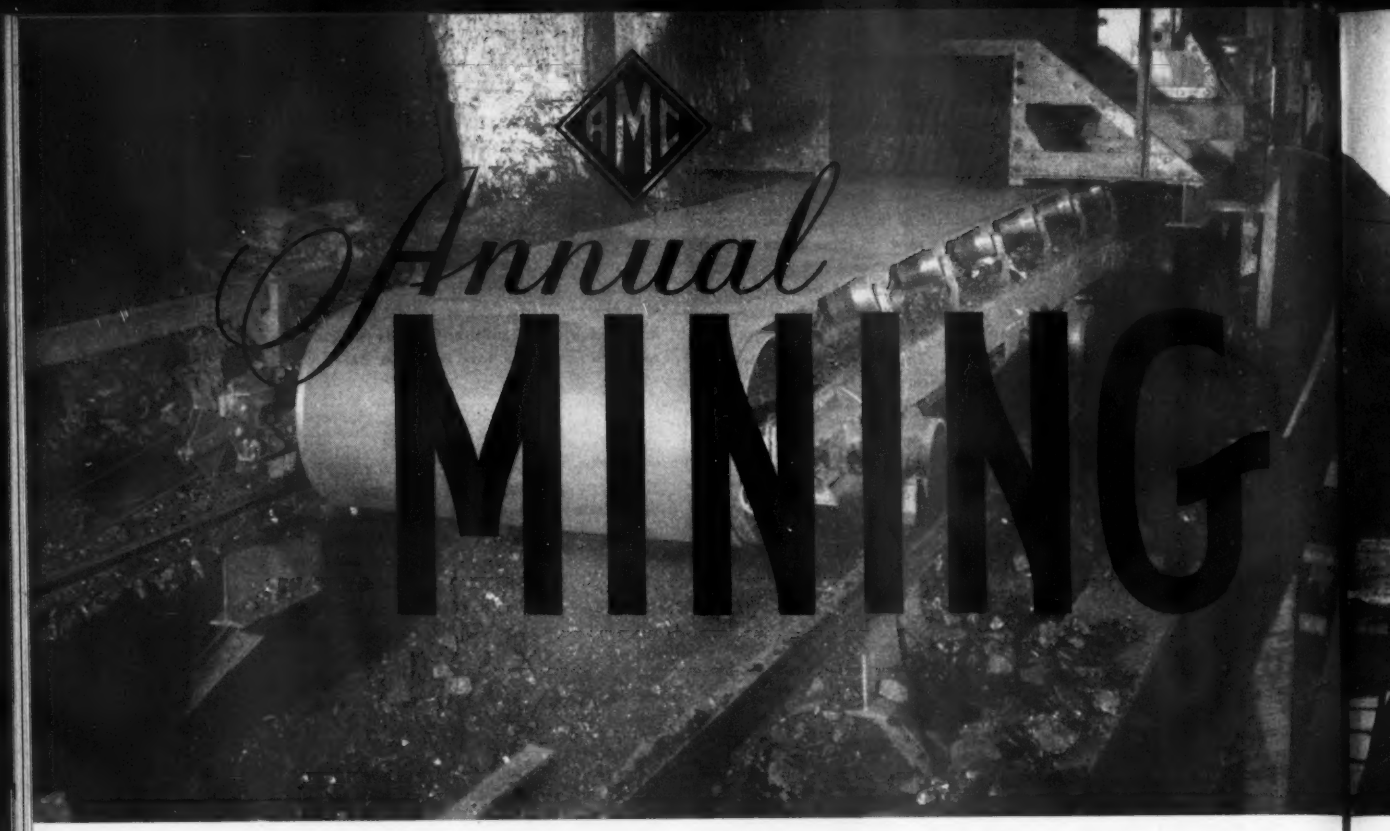
• Through the courtesy of USBM Dr. W. H. YOUNG and Dr. R. L. ANDERSON, respectively Chief, Bituminous Coal Section and Engineer-economist, contribute the annual review of sales of mechanical loading and cleaning equipment. This article on page 96 provides a measure of the new facilities for production of the nation's prime source of energy.

• HON. PAT McCARRAN is Senator from Nevada, the Silver State. In the course of his long career he has served the people of his state and the nation, ably and well. He is thoroughly familiar with the silver situation and the timely review of that topic, which bears his name, is on page 104.

• Dr. DONALD H. McLAUGHLIN, president, Homestake Mining Co., needs no introduction to the mining industry. His long championship of the gold standard and keen understanding of the industry combine to make his article on the status of gold in the world economic picture required reading. It will be found on page 102.

• HOMER JENSEN, chief of the magnetometer division of the Aero Service Corp., began his work with the airborne magnetometer in 1943 with the Naval Ordnance Laboratory's development program. In 1944 he was a party to the first successful tests of the airborne magnetometer in geophysical surveys. His experience from the Arctic to the tropics permits him to speak with authority in the article on exploration with the airborne magnetometer on page 106.

• J. L. WEAVER is development engineer for the American Cyanamid Co. in the phosphate fields of Florida. His position requires that he be familiar with latest advances in mining and treatment of phosphate rock. His review of the industry on page 99 is a keen analysis of the past year and the future outlook.



Modern Mechanical Coal Mining

Advances in Continuous Mining and Roof Bolting Mark Year

By JAMES L. HAMILTON
Vice-President
Island Creek Coal Co.

BESET with a poor first quarter in 1950, a result of three-day weeks and periods of complete shutdown, and having been diagnosed a "sick" industry by some of the economic physicians throughout the country, this so-called "sick" bituminous coal mining industry was cured with a dose of contractual negotiations and came back to the extent that annual production for 1950 surpassed 500,000,000 tons. To those not familiar with the potentialities of the industry, such performance must be astounding, especially when one stops to consider that the general public more or less looked upon the industry as a tottering giant who had lost his balance and was falling into oblivion.

In considering the industry's capacity for coming back, it is found that the greatest single factor contributing to its ability to "roll with the punches" is the continued and increasing application of sound mechanical mining techniques. The Korean situation probably tended to help the over-all production figures for 1950, but it is a moot question whether the war factor had as great an effect on increased coal production as some contend. Be that as it may, the industry met additional demands as presented without any particular fuss or furor.

In highlighting the more important and noteworthy developments in 1950, due consideration must first be given to the underlying theme for the entire industry—increased tons per employe, plus finest quality coal produced with the greatest possible safety. With all efforts aimed at this threefold objective, the following is a partial list of the trends of major interest during the past year:

(1) Continued and increased interest in continuous mining
(2) Increased use of roof bolting
(3) Accelerated trend to thin seam mining
(4) Further development of management tools and techniques
(5) Continued trend to trackless mining
(6) Increased use of compressed air shooting
(7) Increased use of 100 percent belt haulage from face to mine opening
(8) Increase in washers designed for "full seam" cleaning.

Some other noteworthy developments which may or may not be of major interest are:

(1) Increased availability and choice of cutting steels
(2) Improved mechanical bug-dusting
(3) Greater use of plastic materials
(4) Improved hydraulic drive equipment
(5) More interest in a-c power underground
(6) Continued work on underground Diesel locomotives.

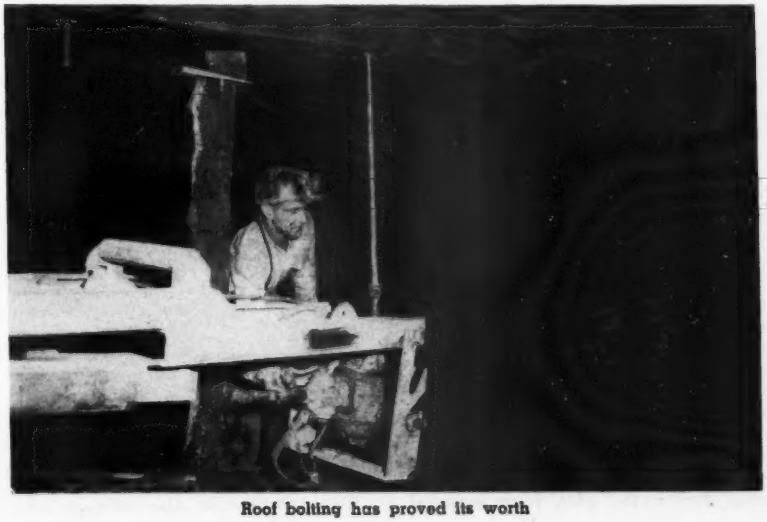
Continuous Mining

The past 12 months have witnessed still greater interest in continuous mining and the complementary service operations necessary for satisfactory operation. It is well to recognize, however, that continuous mining for the most part is still in the development stage. Most operators owning such machines contend that they are in the experimental period. Changes in continuous miner design, as dictated by actual operating difficulties, have been effected. Two additional types of continuous mining machines entered the field in 1950.

Continuous mining is here to stay and much has been accomplished towards solving the problems involved in attaining ultimate performance. With respect to the machines themselves, one of the major problems resulting from continued trials was the amount of out-of-service time because of mechanical and electrical failures. Design changes have eliminated some of the difficulties and experience has dictated improved maintenance procedures and better power layouts. On the whole, lost time from machine breakdowns has been greatly reduced.

With the larger sizes highly desired in many commercial fields, the question of the size consist of the continuous mining machine product arises. This problem varies with different seams. Possibly many operators who might otherwise use continuous mining equipment are waiting to see if possible labor savings will be offset by lower realization because of a smaller size consist. Moreover, there is the problem of adapting existing cleaning facilities to the handling of a continuous miner product. Some operators are justifiably hesitant until they have satisfied themselves with respect to the adequacy of present plants.

Much attention is being given to the complementary operations incidental to continuous mining in order to attain the greatest possible continuity in coal flow. Until these problems are reasonably solved, the machine will be continuous in name only. True continuity means that the machine must work without interruptions for the performance of tasks incidental to keeping the miner in coal. Current mining systems present definite prob-



Roof bolting has proved its worth

Thin seam mining received added impetus

lems with respect to those face operations that must be carried on almost simultaneously with the loading, such as timbering or bolting, brattice-work, drainage, and rockdusting. Transportation is a major problem with few of the present schemes even close to the ultimate solution. These matters are receiving much thought and in the light of past inventiveness and ingenuity, there is no doubt the solution will be found.

It is well to keep in mind the headaches and heartaches that accompanied the successful development of presently accepted mining machines. There is every reason to believe that continuous mining machines will in due time take their rightful place in the orderly evolution of bituminous coal mining equipment.

Roof Bolting Progress

Roof bolting as a means of roof support continued its phenomenal growth. Much effort was directed toward the development of roof bolting equipment and a tremendous amount of information has been developed by the U. S. Bureau of Mines in determining and recommending proper procedures in various types of roof strata. More than ever, it can be said that roof bolting is not the panacea for all bad roof but that, generally speaking, it has proved its worth. In those localities, where bolting alone without additional timbering is permissible, there is a definitely discernible increase in face productivity. Some rather awe-inspiring estimates have been made concerning the percentage increase in production efficiency as a result of bolted roof. A realistic appraisal of the situation will determine that this figure averages somewhere from 10 to 20 percent, a most worthwhile increase.

In conjunction with percussion drilling for bolting there has been a number of dust collection devices on trial during the past year, none of these have yet met with unqualified approval by the industry. In an attempt to depart from the inconveniences of wet drilling, an improved rotary drill for bolt holes is expected but no conclusive information is yet available. Rubber-tired, self-propelled compressors have received considerable attention for use with roof bolting and some companies have installed central surface compressor stations for bolting purposes. These have worked out quite satisfactorily.

In addition to providing additional headroom where every extra inch counts, roof bolting has been of great value in certain thinner seams where the strata are adaptable and where the operating cycle permits. Wood pins for roof bolting have received some attention during the past year but are not in general use. The Korean situation has shown that the steel in roof bolts is just as subject to supply and demand as any other steel products from the standpoint of both price and delivery.

Thin Seam Mining

Thicker seams of quality coal are being rapidly depleted. Many of the thinner seams contain a better quality coal than most of the remaining thick seams. As a result added impetus was given during 1950 to the trend toward mining thin seams. When one considers the area necessary to open up and produce a considerable daily tonnage from a thin seam and the equipment required to handle coal in quantity economically and efficiently with limited head-room, some of the problems of thin seam mining become apparent.

Some equipment manufacturers, contemplating the development of machines to cover a complete range of seam heights, have manufactured pilot models for thinner seams on the basis that future markets for the lower machines warrant development.

The increase in the tonnage annually produced from thin seams has naturally resulted in greater attention to new and better thin seam equipment. Some outstanding developments along these lines are:

(1) New models of mobile loaders and shuttle cars for thin seams
(2) Greatly improved shaker conveyor drives
(3) Column troughing for shaker conveyors
(4) Hydraulic hold-down jacks
(5) Improved equipment for slewing duckbill heads
(6) Improved takeups on chain conveyors
(7) The "piggy-back" transition conveyor for use in conjunction with loading onto conveyors with mobile loaders
(8) Improved mechanical bug-dusters.

This list is representative of some of the worthwhile advancements in thin seam equipment. Most of these advancements were forthcoming during 1950, a general idea is obtained of the increased importance of thin seam mining. Each of the listed items is worthwhile and through such advancements economical mining of seams hitherto unthought of becomes more nearly a reality. To those not familiar with mining 30-36-in. coal it takes only a bit of imagination to realize the benefits of such improvements. For example, the hydraulic hold-down jack has been credited with increasing the effective loading time by 5 percent on certain shaker conveyor set-ups.

Management Techniques

As the result of a more widespread interest in arriving at ways and means of combating some of the difficulties and inefficiencies of modern mining, operators have been measuring various suggested techniques for improving the over-all management of properties. Among some of the techniques that have been found worthwhile are the selection of per-

sonnel right down to the man at the face through planned evaluation and appraisal by trained men, effective training procedures for supervisory employes, and controlled incentive plans.

Another management aid that has proved popular and useful is the systematic and effective use of time study. Time study is not new to the bituminous industry and it has long been a valued management tool in many manufacturing industries. The *proper* use of time study for evaluating performance and for highlighting operational difficulties is just recently becoming recognized for its true worth. Time studies require accurate interpretation and prompt follow-up to result in the desired effectiveness. As management becomes more interested in getting the utmost out of equipment, time study can go a long way towards helping attain that goal.

Trackless Mining

The swing to trackless mining has continued during 1950. All major manufacturers of mining equipment are now in the field of trackless machines and a greater choice of equipment is available. Competition is likely to result in better equipment.

Rubber haulage in the form of belt conveying from face to pit mouth has increased in popularity but as yet is more the exception than the rule. Compressed air shooting continues to become more widespread and will probably continue to grow since it provides a means to an end in quite a few mines where other means of breaking down coal are not nearly as satisfactory.

In striving for the greatest possible efficiency in the relationship between production costs and coal quality, the trend continues toward cleaning plants that will satisfactorily wash "full-seam" output. The installation of such plants minimizes sorting at the loading face thereby permitting greater leeway in operations where loading efficiency can be greatly increased, with attendant decrease in mining costs. Quality objectives have increased the trend towards additions of fine coal cleaning plants to existing washers in order to turn out coal that can stand on its own in a highly competitive market.

Hydraulic Drive Units

There has been continued advance in the design and satisfactory operation of various hydraulic drive units. Hand-in-hand with this advance has been a greater interest in a-c power underground. A series of hydraulic drives working from one or two pumps powered by constant speed motors has given considerable latitude in which to experiment with a-c power. Work continues on the development of a permissible underground Diesel locomotive. In the light of accomplishment along such lines in some European countries there is every reason to expect that domestic designers will soon come up with a unit to meet all specifications.

Industry Cooperation

It has been most gratifying during the past year to see the sincere spirit of cooperation evidenced between equipment and service suppliers and the coal producers. Manufacturers are viewing the problems facing the industry more sympathetically and are guiding their efforts towards overcoming difficulties through new or better machines and design. The various service industries have been most helpful in doing their best to aid the industry in setting up its operations to derive the utmost benefit from the various services in question. This cooperation is as it should be, but the willingness and desire to cooperate were more in evidence in 1950. The furtherance of this splendid relationship will go far toward helping the industry remain a steady, well-balanced member of the nation's industrial family.

The bituminous industry can take pride in its 1950 record, especially in the field of mechanical mining. The industry as a whole fully recognizes the problems which beset it at this time. Chief among these is to recapture the ability to mine quality coal at competitive costs. Likewise the industry recognizes that only through well planned mechanization can the goals of cost and quality be reached.

Being cognizant of the basic problems and their obvious solutions, the entire industry must take stock of its utilization of presently operating equipment. There is room for vast improvement throughout the coal fields along this line. Only through honest evaluation of present performance, followed by hard work and clear thinking can the industry hope to obtain the fullest exploitation of presently-owned equipment.

There is no easy way, no magic way, to get the results which must be had if the industry is to hold its own in its present markets. The tools are at hand and more and better ones will be forthcoming. The efficient and productive use of these tools, upon which future progress depends, rests on the collective shoulders of the industry.

The year 1950 demonstrated what can be done. There is no reason to think that 1951 should not witness still greater strides ahead in the solid advancement of mechanical mining practices and equipment.

Continuous mining has attracted greater attention and is here to stay

Shuttle cars found increased use

Power shovel helps in shaft sinking—still the toughest mucking problem

Concrete is used in many ways

Metal Mining Practice

Production Methods Improve as Industry Prepares to Meet Emergency Demands

By VINTON H. CLARKE

Mining Engineer,
Howe Sound Co.

WITH the beginning of the second half of the 20th century metal mining entered a new period of uncertainty. Government has been following a policy of expediency and industry has been forced to change its plan of action to fit economic vicissitudes. It is no longer possible to make long range plans with assurance of accuracy; it is necessary to plan for the worst and leave some room for optimism.

At present, metal mine operators are again confronted with the urgency of more production along with wage demands and material and labor shortages. Operators met this challenge with courage and aggressiveness before and will do the job again.

For the last ten years there has been a constant search for new methods and new equipment to mine more efficiently. All operators have been out to "pick their neighbors' brains," so to speak, for ideas and have enjoyed a full measure of cooperation and professional interrespect. There is a general feeling of friendly competition to be the first to use a new technique and to come up with a few more good ideas than your neighbor.

Research was never more important than it is today. New techniques, equipment and theories must be evaluated in terms of dollars and cents as applied to the conditions present at each mine. The margin between costs and metal prices narrows and operators are forced to economy of operation in poor times because of prices and competition for markets, and in good times because of high costs, high taxes, and low labor supply.

New Equipment Alters Methods

Basic mining methods have changed but little in past years. But refinements, in some cases, are changing the looks of the original article. Caving operations continue to experiment with larger blocks. It is reported that blocks vary from 160 by 160 to 200 by 240 ft and up to 400 ft in height in the asbestos mines. There, dry sand tailing is dumped on top of caving blocks to support the sides of neighboring mines. On the other hand, small blocks are proving highly successful in some inclined ore bodies such as the Mather A mine in Michigan. Sub-level stoping advances in technique are almost entirely attributed to improvements in drilling. Long-hole drilling with tungsten carbide bits has expanded. Diamond drilling has held its own in spite of high diamond costs, according to a recent survey. There is a continuing trend toward cut and fill mining. The reason for this seems to be improvement in costs due to more efficient filling.

Improvements in methods have developed from the application of new mechanical equipment and blasting practices. Every operator is acutely aware of the importance of cycle planning and this becomes increasingly important when high cost equipment is on the job. Equipment manufacturers are putting much thought into developing machines that can be utilized for more hours per shift. Mines cannot afford to have high-cost units idle.

There is a definite trend toward unit equipment. The USBM experimental mine at Rifle, Colo., has done much to show what can be done with large capacity drilling and mucking units. Air and water line costs have been eliminated there by portable Diesel powered compressors and tank units. D. I. Hayes' stope mucking "Gismo" can now be converted quickly to a jumbo. The trend is toward one machine that can do anything, not a continuous miner as yet, but at least in that direction.

New Drilling Trends Appear

Mining men have followed jet piercing with the hope of finding a tool that will do the job better. Linde Air Products Co. reports that although their first actual mining experience was underground, with incident ventilation problems, the final obstacle is one of supplying oxygen and fuel to the working face. It is not felt, at least for the near future, that application of the method underground will be practical. Some ten companies are using jet piercing at the present time. The method is best suited to high silica-bearing rocks and definitely does not compete in soft rock with conventional drilling methods. Holes, usually

smooth-sided, are pierced from 1¼ in. in diameter, through 2¼ in., 3½ in., 6½ in., up to an expanded blasthole size of 9¾ in.

Today the miners' tools determine how efficiently he does the job. Not the least important of these tools are drill steel and bits. The use of tungsten carbide bits has increased greatly. Longer bit life has put a premium on drill steel. The answer in many cases has been alloy steel rods. However, much trouble resulted from the use of alloy steel and not a few companies have returned to carbon steel. The problem of working and heat treating alloy steel has received a great deal of thought at various plants and seems to have been solved satisfactorily at some.

Reports indicate that, where the tungsten-carbide insert is an integral part of the rod, fairly good performance is obtained. Where holes of less than 1½-in. gauge are desired, this type of bit and steel combination is considered almost necessary. With this setup, of course, the old problem of nipping steel returns, particularly in hard ground where steel must be reground frequently. An attempt to get away from this regrinding problem is being made in experimental bits with a thin insert, using the self-sharpening principle. (There is a definite trend toward longer holes and fewer steel changes when using carbide bits.)

Rock drills and jumbos received much attention. There are several good boom-type jumbos on the market. This equipment, used with long shell machines and carbide bits, has again put pressure on the mucking end of the cycle. Jumbos are best adapted to places of easy access.

Perhaps the machine which commanded the greatest interest during the year was the light 40-50-lb jackhammer type used with a jackleg. The use of this machine has increased greatly in Canada and is catching on in the States. It is best adapted for stope work, although it will compete with leyners in inaccessible drifts, slashing, and other applications where setup time is a large factor. Low first cost, maintenance, and air consumption are advantages that operators cannot fail to appreciate. One mine reports a reduction of 25 percent in stope labor using these machines in medium hard ground.

Shovelling Progress

Demands for more production per shift are being met by giving attention to types of cable, blocks, buckets, and drawhole design in scraping and improved illumination. The new round-the-corner sheave block seems to offer many possibilities. Shovelling from drawpoints directly into cars is advantageous in development, however the handling of large rock has not been too satisfactory. Where head room is great, as is the case in some of the limestone mines, the Tri-State area and in the Rifle oil shale mine, Diesel shovels are being successfully used. In mines where large openings cannot be made, and yet rock is hard and breaks large, there is a distinct need for new equipment. A new overhead shovelling machine recently put on the market, requiring 8½-ft clearance, may do this job. Boom conveyor loaders also show possibilities if built to handle rough rock.

Shaft sinking still presents the toughest shovelling job. The clam shell and power shovel are doing a good job in some vertical shafts, although much sinking is still being done by hand methods.

Blasting

Fragmentation is a big problem at many mines and research men are alert to the effect of rising explosives costs on mine economics. During 1950 fast delay caps have been used to good advantage, particularly in quarries. Results from underground stoping tests have been obscure but it is felt that, once the proper delay combination is found, performance underground will equal that in quarries. Fast delay caps for development headings are being accepted slowly. Under proper supervision their use gives results that are superior to old methods in most ground. However, it is found that there is a tendency to overdrill because of lack of confidence in the detonator. With improper delays, drift rounds tend to throw the broken rock rather than heap it up.

Shaped charges are still in use but the great hopes once held for them have not been borne out. They perform some useful work in bringing down high rocks in drawholes and chutes where safety is the prime object. A new blasthole loader that air-feeds a rubber tamper into the hole is being tested experimentally. An extremely light drill is available to be used with ⅝-in. carbide bits having waterways. This combination would seem to have application in secondary breaking in some types of rock, providing proper explosives are available.

In the present emergency the explosives industry is again faced with shortages of glycerine and glycol. Active study is being given to develop substitute materials.

Mine Supports

Steel drift sets are used in many mines. Miami is experimenting with a circular steel drift set with indications of several advantages in their extremely heavy ground. Steel and concrete shafts are now commonplace in metal mines. Concrete is being used in many ways. Lakeshore is using concrete plugs to help combat rock stresses at considerable depth. International Nickel is concreting ore passes in stopes as the face advances.

Ten companies are using jet piercing

Thin layers of concrete are also being used to replace timber floors in some cut and fill mines. Climax's practice and others of concreting slusher drifts is well known. The Tri-State practice of giving pillars additional support by cable binding has been tried with success in other areas. Roof bolting has had a tremendous boom during 1950 particularly in coal and iron mines. It is reported that Butte is studying this technique and has had experience showing bolts standing up well after ten years of service. Also at Butte, packaged timber and mechanized timber handling has made great strides.

Stope Filling

Sand tailings have been pumped underground for many years at Homestake and Matahambre. At the latter, deslimed sands are sent into the cut and fill stopes at 45 percent solids

more or less continuously. Two pipe lines are used to provide for stope preparation. Central Eureka and Idaho Maryland use a decanting system to eliminate only a part of the slimes before sending it to the stopes. This system is known as the sand-slime method. Dry pit sand has been used for years by many Canadian mines. In most cases where dry sand is used clay and fines must be low so that water will percolate. Desirable percolation rates vary from a low of about 6 in. per minute, depending on quantities of underground water and past experience. Mines using the sand-slime method stress the importance of an inherently strong type of fill and apparently have not been bothered by water and sand surges after stopes are filled. Deslimed mill tailing has been used for years for filling open stope mines. This type of fill is being pumped long distances at up to 50 percent density. Sand-slime fill is being sent into some mines at up to 70 percent density.

The Dutch States cyclone commonly used in coal cleaning plants and on other desliming jobs is being tested on extremely fine tailing material, with the object of eliminating a high enough percentage of the slimes to obtain a product having a 6-in. per minute percolation rate. Another company wishes to use the cyclone as a primary deslimer at the mill and a dewatering machine at the mine and of the sand line. Research work is encouraging.

Underground Transportation

More Diesel haulage equipment is in use. Scrubbers are used to reduce the oxides of nitrogen and the aldehydes in the exhaust gas. Eagle Picher has used oxygen for some time to reduce the CO content of exhausts from trucks, loaders, road graders, bulldozers and others. A Diesel-powered portable compressor is in use for developing outlying mines and a Diesel jeep is being used in a large mine for the supervisory force.

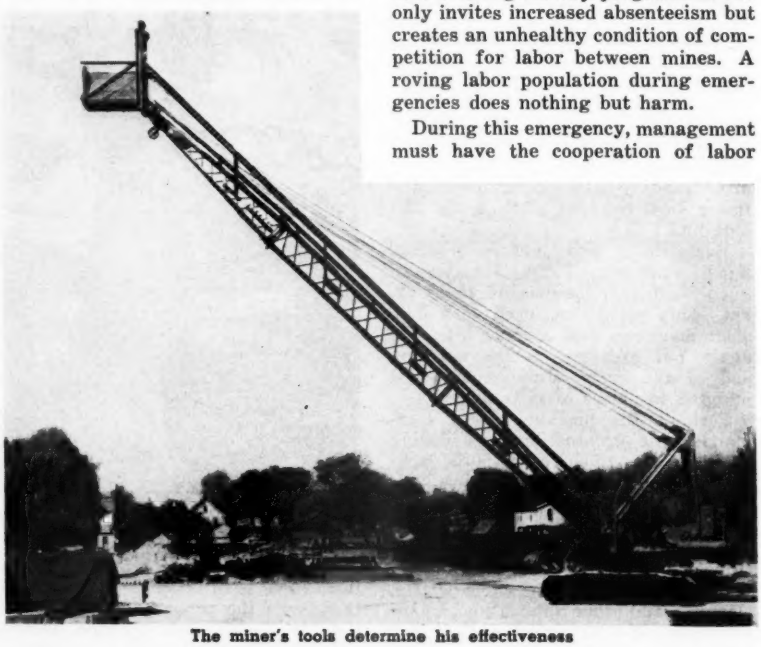
Shuttle cars and other trackless equipment are finding extensive application in flat lying deposits. Conveyor installations, such as the one at Pend Oreille, remind metal miners of the advantages of this system in certain ore deposits. Truck transportation continues to increase mainly because of its adaptability to varying conditions. C. R. Burton states that Diesel trucks on the iron range vary in horsepower from 27 to 550 and that the use of the hydraulic torque converter in supplying a stepless automotive transmission has made great strides. He adds that the use of gas turbine engines will have to be watched carefully.

Ventilation and Safety

Good ventilation becomes more essential as modern equipment trends towards larger, fast-moving machines. Most ventilation authorities agree that adequate ventilation can greatly reduce dust hazards and, in some cases, completely eliminate them. The constant every-day changes in ventilating conditions caused by development heading break-throughs, leaks, etc., do, however, make it nearly impossible to completely eliminate dust hazards.

The use of aluminum dust to reduce the incidence of silicosis in this country has been a highly controversial subject. A recent statement by the USBM indicates that they wish to maintain a neutral stand in the matter. Their views are essentially those of the American Medical Association. A positive stand has been taken on this matter in Canada where it is reported that 64 miners are using aluminum therapy under contract with McIntyre Research, Ltd. The use of this method is more or less compulsory in British Columbia since the Compensation Board has the right to increase the silicosis assessment of any mine not using the method. The government of Western Australia has made the use of aluminum dust compulsory for its 14 producing mines. In Mexico, four mines are at present using the method and one is preparing to do so. The USBM reports there are possibly 20 mining companies in the U. S. using the aluminum dust system.

Ventilation and safety for the most part go hand in hand. Still the most important factor in reducing accidents is the training program with its constant emphasis on safety consciousness. Some mines have made the wearing of safety glasses compulsory and it has developed that the wearing of glasses has created a safety consciousness not present before.



The miner's tools determine his effectiveness

Labor Management Cooperation

Metal mining in 1950 was marked by the courage of those who went into Labrador and Venezuela for iron ore, by those who decided to open up the titanium reserves in Quebec and by those who invested great sums on taconite research, plus many others who expanded and built new plants. Notwithstanding future uncertainties, mining continued to be aggressive—it has to be to live!

During the last war, the operators' biggest headache was labor. It was not only short but poor. Every conceivable incentive was tried in the common effort to raise output per man shift. Labor-management programs, more and better safety programs, entertainment, educational plans and incentive bonus systems were stressed. The latter, above a certain point, is useless and rapidly approaches the status of a giveaway program. It not only invites increased absenteeism but creates an unhealthy condition of competition for labor between mines. A roving labor population during emergencies does nothing but harm.

During this emergency, management must have the cooperation of labor leaders. Cooperation is a two-way street and both parties must be going in the same direction. This time, every effort should be made to prevent labor leaders from using the labor market as a lever for advancing their own ends. Production levels attained during the last war could have been greatly increased if the constant pulling, hauling and agitation created by some union leaders were eliminated. Such bickering sapped the strength of both management and labor, a fact recognized and utilized by the Communists. With the full cooperation of management and labor leaders, these United States can produce quantities of raw materials never dreamed of by Joe Stalin.

Interest in new plants and equipment was high

Coal Preparation

Total Mechanization and Continuous Mining Affected Preparation Practice

By R. L. LLEWELLYN

Preparation Engineer
Eastern Gas & Fuel Associates

DURING 1950 the construction of new preparation plants decreased, with the first quarter shutdown largely responsible. Much contemplated plant construction had to be postponed, delaying coal preparation expansion programs.

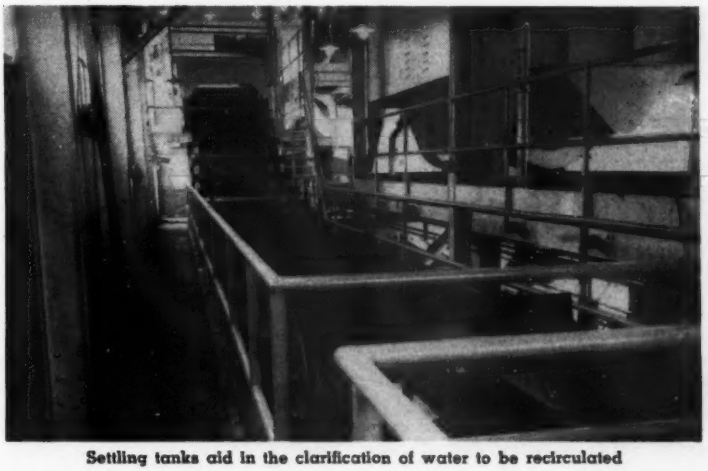
However, a marked interest in new plants and equipment was evident. A buyer's market plus the fact that many new cleaning plants showed a definite financial advantage, were the prime factors for the consideration of new installations. Modernization of existing plants has been completed and more efficient cleaning units have reduced coal losses in refuse to a minimum. Also, additional facilities have been installed to lower the ash in the slack sizes and to recover the coal which was formerly wasted in the slurry.

Total mechanization and continuous mining play an important part in the need of complete preparation plants. With the increased amount of rejects caused by full-seam mining, the problems confronting the coal preparation engineer are multiplied.

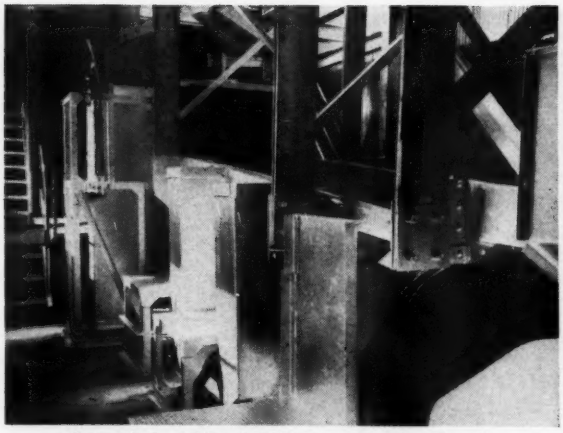
Refuse Disposal

The selection of the refuse handling system is important both from an operating and economic standpoint. Each installation must be studied carefully and cost comparisons made to determine which method to select. Aerial tramways were installed at many plants where the disposal area was suitable, and the terrain favorable. At others, belt conveyors were used to deliver refuse to the mountain top for final disposal. In some locations large trucks handle the rejects. However, with any system, the prevention of refuse fires merits careful consideration. Restrictions have been placed on some plants in areas where the gases released in burning were objectionable to surrounding towns. An American Mining Congress committee has been studying the problem of burning gob piles, and its findings will no doubt prove valuable.

As to the handling of extremely large slate at the preparation plant, there are many who advocate crushing the entire ROM product before entering the plant. Although this may be the solution in some instances, it should not be taken as the "cure-all." The selection of the cleaning and auxiliary equipment is greatly affected by the decision to crush the entire production. Certainly design will be changed and the need of fine coal cleaning becomes necessary in most cases. The water clarification prob-



Settling tanks aid in the clarification of water to be recirculated



Out-moded picking facilities were replaced with shaker-type picking tables

Baum jig continued to lead in tons of coal cleaned

lem also may become more difficult, depending upon the sliming of the refuse in water.

Out-moded picking facilities must be replaced with new equipment to handle large slate. Shaker-type picking tables replace old types to allow the picker to remove the material without lifting heavy pieces. The installation problem is magnified considerably because new facilities must be installed without a production shutdown.

In some new plants large slate is scalped off separately and delivered directly to the refuse system. Rotating breakers accomplish this where the coal is soft enough to be broken down and removed through the screen plate holes in the breaker. Shaker-type tables permit the removal of the slate by pickers; and, where extremely large slate is encountered, rock crushers reduce the size so that the material can be readily handled without damaging refuse disposal equipment.

Raw Coal Handling

The market for lump has declined with some coals to the extent that the loading of this size has been discontinued. A decrease in the amount of lump with mechanical loading, coupled with the small price differential between the lump and egg sizes, has made the product undesirable from an economic standpoint. Without lump, the top size is reduced to, say, 5, 6 or 8 in. by crushing and is reassembled with the natural 5 in. by 0, 6 in. by 0 or 8 in. by 0, to be further treated. Single roll and double roll crushers have been installed for this duty with segment rolls made of special alloy iron to withstand wear and reduce maintenance. With soft coals the pick breaker has an advantage of producing a crushed product with a minimum amount of fines.

For some years captive mines have installed large blending and storage bins ahead of preparation plants to insure a well blended product. Although commercial companies have not invested to any great extent in similar facilities, there is a definite trend to provide constant feed by installing raw coal bins to insure a full operating shift against minor delays. At existing plants this storage can be generally accomplished with a sufficient number of mine cars. The cost of binning versus the cost of extra mine cars together with the breakage of coal, should be thoroughly studied for new operations to provide a constant feed to the cleaning plant.

Screening Problems

Many existing cleaning plants were designed and installed before the mines were fully mechanized, which fact, together with the depletion of the thicker coal seams, has caused screening facilities to be inadequate. Modernization was necessary by replacing the old equipment with new and more efficient screens and a larger number of units. Spraying at the face to allay the dust has also aggravated the screening problem.

Where pre-sizing ahead of cleaning units is necessary, careful consideration should be given to providing adequate screen area as well as additional space for future units. The vibrating screen is the popular unit to remove the slack size and the selection of cloth is very important to insure maximum screening efficiency. Blinding with damp coal creates the greatest problem, and to overcome this difficulty, many types of cloth of different materials such as spring steel, stainless steel and aluminum, have been installed.

Rubber balls, bouncing against the deck cloth, have also helped to keep the wires free from damp coal. A vibrator is now being recommended with three screen sections on different slopes for screening at ⅛ in. and smaller.

Coarse Coal Wet Washing

The Baum jig continued to lead in tonnage cleaned with dense-medium units increasing in popularity. With the marked increase in the amount of refuse, more producers are recognizing the need of efficient washing. One new plant has a reject capacity of about 46 percent of the feed; therefore, the highest recovery becomes desirable even though all mines may never reach such a refuse handling capacity.

Production has increased at many existing plants to the extent of jeopardizing cleaning efficiency. It should be recognized that efficiency and capacity have a definite relationship; an overloaded condition can cause losses in any cleaning unit.

Prefabricated units have been installed to handle smaller tonnages at existing plants. The equipment is complete with all the screens, hoppers, pumps and piping, with or without the supporting structure. The producer has to bring the coal to and from the new equipment. With such an arrangement a savings in cost is realized due to standardization.

One plant was installed to recover coal containing clay veins. This was formerly wasted with the mine rock. Using a Baum jig to clean 5 in. by 0 at a rate of 200 tph, it is estimated that 300 tons of good metallurgical coal are now recovered each day from this product.

Heavy medium jigging has been demonstrated at several installations with encouraging results. It is reported that, at a plant in West Virginia, a Baum jig is making a separation below 1.40 spc gr with 70 percent near gravity material plus 0.10. The heavy medium is material made from the jig middlings, crushed and recirculated to the feed.

More operating data have been collected on the dense-medium separation. New plants with drum and cone type vessels have operated over a period of

time, and performance, maintenance costs and further operating technique are fairly well established.

Fine Coal Cleaning

Fine coal, which has been increased in amount and in ash content, due to mining methods, has become the major preparation problem facing the coal industry today. The decision to select a wet washing or an air cleaning plant still should be studied thoroughly to determine the operational and economic advantages of each. Where the ash and moisture is considered jointly, there is no particular advantage in reducing the ash percentage and at the same rate increasing the moisture percentage. A complete washability study is required and the predictions of results carefully analyzed before determining what type of fine coal cleaning plant to install.

Several large air cleaning plants have been constructed and placed in operation during the past year. The top size has reached upwards to 1⅝ in. Pre-drying facilities have been included in some of these plants to assure the proper moisture for most efficient cleaning results; and with an ever-increasing amount of spraying at the face, pre-drying with an air cleaning plant should be seriously considered.

The new oscillating type air units installed have shown greater efficiency in cleaning the finer meshes and also a greater recovery due to minimum loss of coal in the refuse. The typical air plant, consisting of several units, usually contains a separate unit for retreating the middlings. However, there is a definite trend toward sending the middlings to a separate wet washer unit for best results and highest efficiency without increasing the total plant cost. The dewatered washed coal can be mixed back with the air cleaned coal to make a satisfactory product in most cases. Because the air cleaner acts as a deduster, the middlings product contains a small amount of 48 mesh by 0 dust, and, for this reason, does not complicate the water clarification problem.

A considerable number of wet washing units were installed during the past year to clean fine coal. Concentrating tables, hydrotators, free discharge launders, spiral separators and froth flotation cells were the types of washers used in the major installations. However, a great tonnage of fine coal is washed in Baum jigs, and without actual figures available, it is not possible to state which unit cleans the most tonnage.

Cleaning results are satisfactory with wet washing; each type having certain advantages—size range and efficiency depending on the characteristics of the particular coal. The problem of space requirements usually plays an important role. If sulphur reduction is of great importance, equipment becomes more involved; for instance, it has been demonstrated in a large plant that classifying the feed ahead of tabling aids in obtaining maximum reduction of ash and sulphur. At the same time, the use of fresh water has aided ash and sulphur reduction rather than using circulating water with the normal percentage of solids in suspension. If adopted, the water clarification would be enlarged to treat all the water rather than a part as in general practice. An additional feature has been successfully installed on concentrating tables at two commercial installations to double the refuse capacity of the unit. This is accomplished by venting the table backboard to provide about eight feet of additional discharge periphery.

Sludge tanks have always been a necessary part of the equipment in wet washing plants but there are some who believe they can be eliminated. In the latest plants the settling area has been increased beyond that previously considered adequate. A plant nearly completed in Ohio will have two large settling tanks; one will be equipped with eight recovery drag conveyors and the other with six. One tank will have 3500 sq ft of settling area and the other 4200 sq ft.

Froth flotation has been demonstrated to have definite possibilities to recover an acceptable ash product from coal slurries. The quantity and type of reagents used are dependent upon the coal handled. Preliminary tests on the coal give an indication of the proper cycle to recommend and results can be predicted on the product.

The spiral separator is another unit used to clean the fine coal and several installations were made in the anthracite field. Laboratory tests on bituminous coal show gratifying results on reducing the ash in the finer sizes.

Mechanical Dewatering

Depending on the system used in a washery, it takes, as an average, about five tons of water to wash one ton of coal. This would mean that the coal coming from the washer unit would be 80 percent moisture before any dewatering. The general practice, therefore, is to remove as much water as possible by a stationary section of

Many mines provided surge capacity with run-of-mine storage bins

Centrifugal dryers reduce moisture content of coal

screen in the sluiceway leading to the dewatering screens. Sufficient area should be provided to remove all the excess water, except for the amount required to discharge the coal from the sluice.

In plants where various sizes are to be prepared, Parrish-type screens are widely used. Additional dewatering of the stoker coal sizes has been obtained by the use of vibrating screens in tandem with Parrish screens. In plants where the washed coal is shipped reassembled, the vibrating dewatering screen lowers the moisture sufficiently without thermal drying on the plus ⅛ in. or ¼ in., as the case may be.

Vertical-screen type centrifuges have been installed in many plants to reduce the moisture in the fine coal. The effluents from such units are either recirculated or sent to the water clarification system for final recovery. The C.M.I., Carpenter and Reineveld units are the three leading screen type centrifuges. A recent development by one of the manufacturers incorporates the use of another unit to increase the total recovery without materially increasing the moisture of the cake. The results on a full scale operation will soon be made available.

The horizontal type centrifuge has gained popularity because of the high recovery, reasonable maintenance when handling coal and the fact that the effluent can be returned to the circulating water system with a minimum of bleed-off water. The higher moisture cake is acceptable in some installations where it is mixed with the coarser coals and shipped as mine run. Deslimed feed, plus the introduction of fresh water into the unit, has resulted in a lower moisture cake. The manufacturer is experimenting with the use of coagulents to obtain a clarified water, and the results of a test plant installation will be available soon.

Special type dewatering vibrating screens have been installed in old and new plants to reduce the moisture in fine coal or sludge at minimum cost. In the construction of these screens, several dams are located along the length of the unit to set up a squeezing action for removing excess water from the fine coal. Results are available for many installations, but it should be remembered that the moisture reduction is dependent upon the opening of the screen cloth as well as the amount of superfines in the feed.

Thermal Drying

The problem of unloading frozen coal during winter months and the paying of freight on water have caused many producers to install drying facilities on stoker coal and finer sizes. To some consumers, wet coal may be more objectionable than a higher ash fuel.

Stoker coal sizes are dried by downdraft, screen-type units which have been the popular choice over the years. A new dryer was developed and several installations made for reducing the moisture in all sizes below 1¼ in. after normal mechanical dewatering. Operating data can now be obtained based on actual experience.

Another recent development is for drying a finer size—say ⅜ in. by 10 mesh. The dryer consists of a slow moving wire cloth belt conveyor covered with a hood and hot gases are directed through the material several times before exhausting to atmosphere. Because of the absence of fines, it is not expected to create a dust problem. The manufacturer believes this dryer can replace the centrifuge in a cleaning plant with lower maintenance cost.

The vertical stack flash dryer and the cascading multi-louvre type dryer were the two major units installed to dry fine coal. The former has a size range of ⅜ in. by 0 and the latter 1¼ in. by 0. The performance of both types has been generally satisfactory as far as moisture reduction is concerned. Both units can be used for predrying before air cleaning if desired. However, with a fluctuating feed moisture, proper controls are very important for automatic and successful operation. The feed moisture varies considerably due to spraying at the face, seasons of the year, or when a trip of mine cars stands in a rain or snow storm at a drift mine.

The problem of dust collection from these dryers has baffled the industry for several years. Many experiments have been made by coal companies at locations where the fine dust escaping to the atmosphere is objectionable. Tests have shown that with dry collection there is still a considerable amount of minus 325-mesh material uncollected. The average particle size of the material varies but it is indicated to be about three to four microns with nearly 80 percent below five microns.

To clean the air satisfactorily with wet collection is entirely feasible, but the water containing these extreme fines must be wasted to a pond. There is also a corrosion problem which means that the unit to be installed should be lined with concrete or rubber. The maintenance can become severe if this lining feature is neglected. Coal companies tackling the dust collection problem have been cooperative in exchanging results and ideas with others.

Water Clarification

Water clarification has become one of the most important phases of coal preparation because of the increasing enforcement of stream pollution laws. Not only are new plants affected, but the old ones as well. Settling ponds are not always possible in mountainous country, and where used there are capacity limitations, not to mention the difficulty of periodic cleanout procedures.

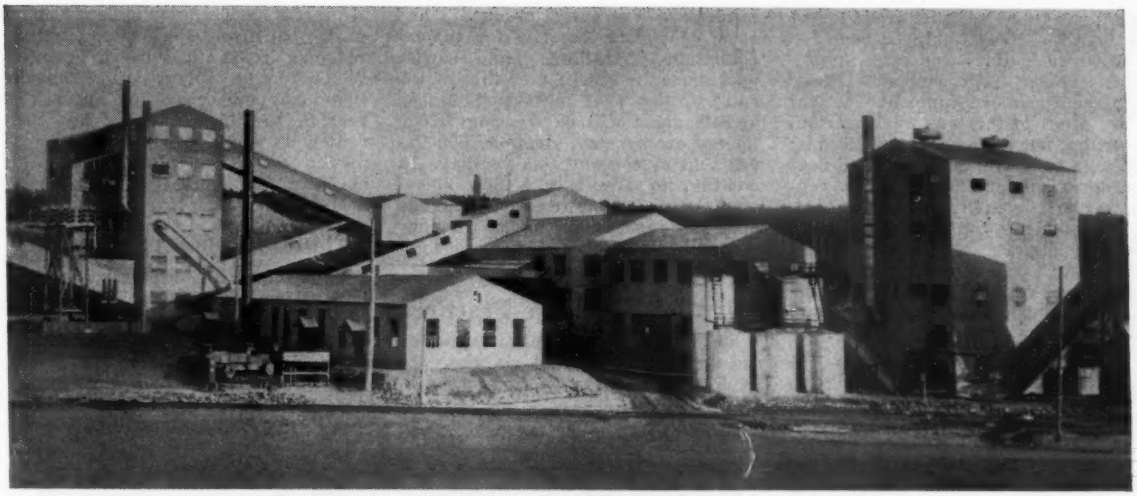
The well-known thickener and vacuum filter have been used for years by companies washing fine coal. With full-seam mining the amount of super fines increased to complicate the problem still further. The term "micron" was not used by preparation men in the past. Today, coal slurry is examined under microscopes in laboratories to determine particle size, and special tests are run to establish settling rates of the different coal seams.

Where the thickener and filter area was large enough for proper settling based on studies made some years ago, many systems have become inadequate in capacity, and must be supplemented with additional facilities in order to provide proper water clarification. The thickener and filter combination has been installed at several large plants during the year in order to clarify the water and prevent stream pollution.

Cyclone thickeners with either cloth type or screen type filters have gained popularity. Where warranted, two different diameter cyclones are used in series with the larger unit classifying the slurry water to recover a marketable coal. The smaller diameter unit is used as a thickener to clarify the circulating water. Maintenance and operating data are now available from coal companies using this equipment.

The horizontal, solid-bowl type centrifuge is also offered for removing solids from waste water. The construction of this unit differs slightly from the regular centrifuge in bowl shape to favor the clarifying action of the machine.

All phases of the many coal preparation problems facing the mining industry today have not been resolved. New equipment installed during the year has performed with encouraging results and operating data should be carefully analyzed to determine individual requirements. Complete washability studies and screen analyses, with future mining conditions thoroughly considered, are all necessary to insure successful coal preparation plant operation.



Taconite preparation plant produces 600 tons of concentrate per day

Advances In Mineral Dressing

Mesabi Range Practice Indicates General Trend

By STRATHMORE R. B. COOKE
Professor of Metallurgy & Mineral Dressing
School of Mines, University of Minnesota

ADVANCES in mineral dressing are composed largely of progress in four related fields; (1) operating practice, (2) applied research, (3) fundamental research and (4) mineral dressing education. Because of their mutual dependence the line of demarcation between the first two fields is necessarily poorly drawn. Operating practice usually shows improvement with time, because with the solving of the big problems the operator has more time to polish up the performance of his individual machines and to work them into a harmoniously operating whole in the flowsheet.

Applied research, covering design of equipment, novel applications of both standard equipment and of what are usually old principles in concentration, comminution, etc., and the determination of new, and it is hoped, better, flowsheets, usually does not proceed so smoothly and normally progresses in a series of jumps. Unfortunately, management sometimes requires tonnage rather than improved recovery, and the operator can carry out the necessary research only by much burning of the midnight oil, and not even then.

One of the most active areas of applied research seems to be the Iron Country in Minnesota, Michigan and Wisconsin. In fact, the great demand made on iron ore reserves by World War II, and the stark realization that there is only sufficient direct-shipping ore left for the next two or three decades has forcibly directed the attention of ore-dressing engineers to the concentration of the low-grade intermediate ores and the taconites. For the purpose of this short article the writer will take advantage of this fact and hang most of his tale on the progress made on the Mesabi Range of Minnesota, with occasional digressions to other areas.

Iron Ore Concentration

Mineral dressing is no "Johnny-come-lately" to the Mesabi, for beneficiation of the wash ores commenced in 1907, and since that time concentrates have contributed an increas-

Some ores require attrition grinding and jigging

ing percentage of the ore shipped. In 1949 the Mesabi shipped over 15,000,000 tons of concentrates, representing about 26.5 percent of total Minnesota iron ore shipments for that year. Much of this was wash-ore concentrates, but the amount produced by jigging, by spiral and sink-and-float concentration, and by magnetic concentration is steadily on the increase.

The problems confronting the ore-dressing engineer on the Mesabi are staggering. One company has plans for a plant capable of producing annually 2,500,000 tons of concentrates, this being one of an anticipated four units with an ultimate annual capacity of 10,000,000 tons of concentrates. Other companies are thinking of production of the same order of magnitude. Ores within any given mining district are usually reasonably similar in their characteristics, so that normally there is not too much disparity in the methods of concentration employed in the district. Unhappily, just the opposite is true of the Mesabi. On the western part of the range the wash ores respond reasonably well to single or double classification, but elsewhere the ores require jigging, heavy density separation, spiral concentration, attrition grinding, hydraulic classification and magnetic concentration; and a host of other methods are being hopefully tested.

Gravity concentration is being pushed to the limit, venturing to fine sizes unthought of a few years ago. Retreatment of the millions of tons of wash ore tailings, containing upward to 20 percent iron, will, apparently, require flotation. Some ores need only superficial crushing or grinding, but at the other extreme there are the magnetic taconites, that must be ground to substantially 70 or 80 percent through 325 mesh to effect liberation. To add to the headache, segregation must often be practiced, because the ore from any one pit or mine is not necessarily uniform in dressing characteristics.

Cyclones as Concentrators

In 1949 the M. A. Hanna Co. used the DSM cyclone as a concentrating device on a pilot plant scale, employing a magnetic medium. The work continued this past summer, results being improved by the added experience gained both in operation of the cyclone and of the magnetic separators. Plant capacity will be increased in 1951, and it is understood that other companies on the Mesabi, as well as some in the Birmingham district, plan to install cyclones as concentrators. It is possible that an experimental installation of cyclones will be used on the Mesabi in 1951 to thicken medium used in heavy-density work, as a substitute for the usual densifiers.

Spiral concentrators are continually being added to plants to treat wash- and jig-type ore in the minus 10-mesh size currently produced, and some are being installed for the reclamation of tailings from earlier operations. It is estimated that by the end of the 1951 operating season spirals alone will be treating 18,000 tons of ore per day, yielding 7500-10,000 tons of concentrates per day. In addition to acquiring a new spiral plant, the Interstate Iron Co. has placed in operation one of the new hydraulically-supported Hydrocone gyratory crushers.

Attrition Grinding Practices

Rod mills are coming into wider use on the Mesabi and elsewhere to reduce the quantity of non-treatable slimes. The center peripheral rod mill of the Mine and Smelter Supply Co. uses "spooled" rods, that is rods having short end sections of somewhat larger diameter than the long center section. Feed is introduced at both ends of the mill so that wedging is reduced, and discharge is effected through peripherally-arranged ports in the mid-section. Designed primarily for sand and gravel preparation for concrete, the mill holds considerable promise for the grinding of intermediate iron ores in which the plus $\frac{3}{16}$-in. material can be treated by sink-and-float, but the minus $\frac{3}{16}$-in. fraction requires grinding prior to the use of other gravity methods. The CPD mill may also prove to be of use in grinding the easily-slimed ores of scheelite, barite and manganese.

It is probable that much of the intermediate ore will be treated with the variety of gravity methods already mentioned, together with processes yet to be devised. However, there is some diversity of opinion regarding treatment of the hematite taconites and the large quantity of gravity tailings. A process has been available for many years that involves a low-temperature reducing roast to convert hematite to magnetite, followed by conventional magnetic separation, but lack of fuel in the Iron Country has prevented its adoption. The recent completion of an oil pipe-line through northern Minnesota from the Alberta fields may have improved its prospects.

Flotation Has Application

Flotation is an obvious solution to the problem of the finely locked hematite ores. Much effort has been expended on the flotation of iron ores, and for non-slime sizes it seems that economically and technologically it is feasible, using either anionic or cationic collectors, and floating either the hematite or the quartz and silicates. One disturbing feature is that flotation of pulps containing sizes finer than 15 or 20 microns is not uniformly successful, both because of high reagent consumption and because of interference in the separation of the slimes. In the light of present knowledge, desliming of most iron ores is essential. This can be effected on a practical scale by either centrifugal classifiers or by a new application of the DSM cyclone.

Fine taconite concentrates are pelletized for blast furnace feed

Concentrating Taconites

Fine grinding followed by magnetic separation can be used to concentrate magnetite taconite and one such plant is in continuous operation at Aurora, producing about 600 tons of concentrates per day. A new flowsheet has been worked out for magnetite taconite in which a strong magnetic cobber follows the rod mill, producing a finished tailing. The concentrate goes to a weak cobber which in turn gives a finished concentrate and a middling.

The middling is sent to a ball mill which returns the ground product directly to the first cobber. This flowsheet eliminates the mechanical classifier and the difficulties of classification associated with fine magnetite particles, which tend to flocculate magnetically. Electro-magnets have hitherto been used in magnetic separators, but a new Norwegian mill for concentrating iron ore will use permanent alnico magnets.

The crux of the problem of beneficiating the hematite and magnetite taconites lies not so much in the type of concentration as in the method of converting the fine concentrate into an acceptable blast furnace feed. Several methods are available, but pelletizing is economically the most attractive provided that certain technological difficulties can be solved. Shaft furnaces are in use for this purpose, but Allis-Chalmers has commenced an investigation of the firing of pellets on a moving grate.

Fine Grinding

In Canada, the Lake Shore, Wright-Hargreaves, and Hollinger properties are using pebble mills for fine grinding to reduce ball wear costs. Noteworthy from the point of size is the installation by Kennecott of four 10½-ft diam by 14-ft ball mills. Through the pages of the AIME publications, Meyers and his associates of Tennessee Copper Corp. are giving invaluable progress reports on their plant-scale experiments in grinding. Allis-Chalmers is conducting an investigation on the testing and design of the vibrating ball mill. This mill, which has particular application in dry-grinding in the micron sizes, consists of a tube supported in such a way as to permit movement in a plane at right angles to its axis. A central tube is attached through which motion is communicated to the mill by eccentrics, the annular space betwen the two tubes being packed with balls. Dry feed and discharge are continuous, and the results are stated to be surprisingly good.

In the southern phosphate fields difficulty was experienced in screening at four mm, so re-pulping pockets were added to the screens with greatly improved results. In the laboratory it is difficult to screen most clays and other moist materials. The W. S. Tyler Co. has introduced electrically-heated screens which dispose of this difficulty. Haultain has introduced a new two-tube infrasizer; this does not replace the older seven-tube device essential for research, but it will enable the mill operator to obtain a quick sizing analysis to check performance.

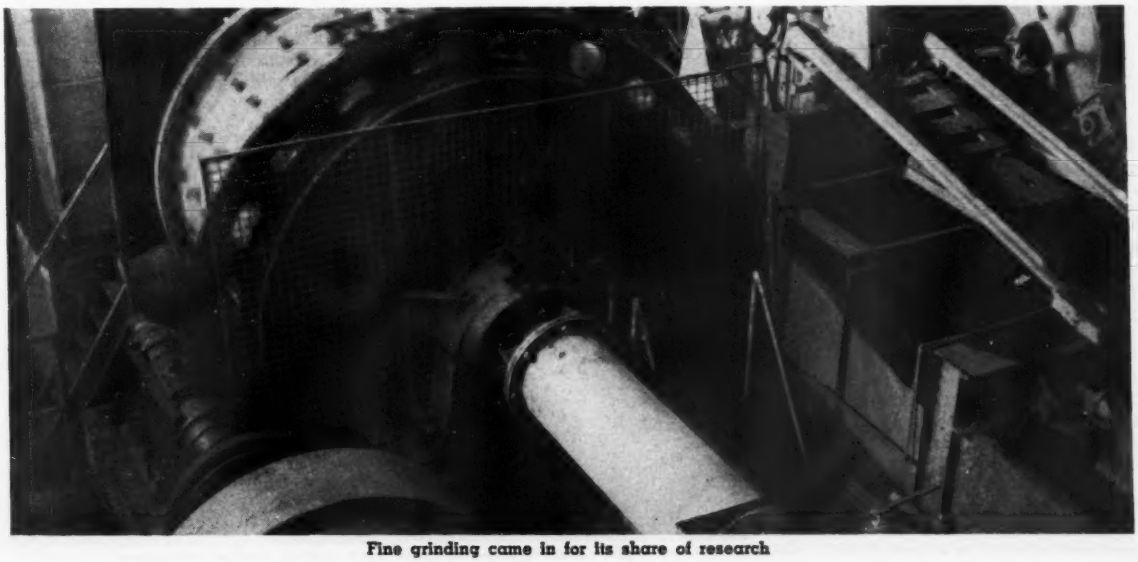
To ascertain the effect of removing a fairly high grade of concentrate, the manufacturers of the Humphrey spiral are experimenting with a first and second stage of spirals between the ball mill and the classifier. It is believed that with some ores it will be possible to take a wide cut on the first stage, reconcentrating in the second stage, and producing a classifier overflow which is a final tailing.

Instrumentation

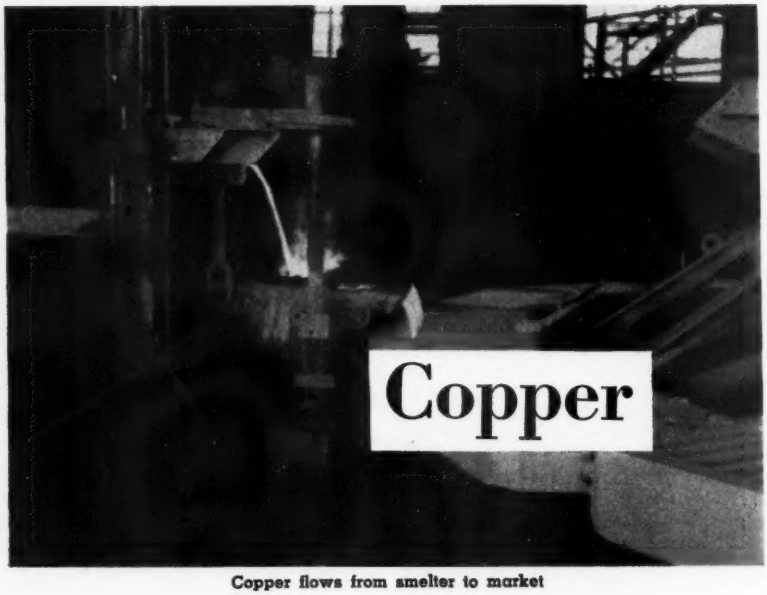
The use by chemical engineers of control equipment has long excited the envy of mineral dressers. The Hardinge electric ear was a step in the right direction, and now Allis-Chalmers has developed and patented an automatic grinding-circuit control system based on the turbidity of the classifier overflow. One experimental unit has been installed in a mill to ascertain its capabilities in continuous operation, but further development is required because both pulp dilution and particle size affect turbidity. A preliminary report on the operation of the Massco circuitron was made in 1950. In this system a dual control is imposed on the grinding circuit by using both ball mill noise and variation of power draft to the classifier with the sand lead to control the feed to the mill. Development work has been completed and in a recent installation at the National Lead Co. mill at Fredericktown, Mo., the unit has been successful, both in increasing tonnage and in giving better metallurgical results in the flotation circuit by preventing feed surges and maintaining constant density in the classifier overflow. Bean has recently described an automatic density recording instrument for Heavy-Media separation units that can also be used to control the water added to the medium returned from the densifier, and hence to maintain the density of the circulating medium.

Perhaps the high-light of the year's work in fundamental research in mineral dressing was a paper by Gaudin and Bloecher reporting investigation of the partition of a cationic collector between quartz and water, using the radioactive tracer method. A most surprising result is that almost complete recovery of quartz in flotation is obtained with only five percent of the total computed adsorption sites occupied by amine chains, not the 100 percent corresponding to the generally assumed mono-molecular film.

In the field of mineral dressing education, a recent announcement advises that Professor Taggart has written a new book in which the order of presentation is such that concentration procedes comminution. This is bound to have a favorable effect on the interest of the students. The inclusion of an appendix on laboratory experiments and report writing will also satisfy a great need in this field.



Fine grinding came in for its share of research



Copper flows from smelter to market

Despite High Production Defense Demand Exceeded Supply

By C. H. WINSHIP, JR.

Sales Manager,
Phelps Dodge Refining Corp.

THE strong demand for copper which started in the early fall of 1949 continued throughout the entire year 1950. The price per pound at the beginning of the year was 18½¢. In April the price moved up to 19½¢; in May it advanced another cent to 20½¢; in early June the price increased again to 22½¢ and in September a price of 24½¢ per pound was established and remained in effect for the balance of the year.

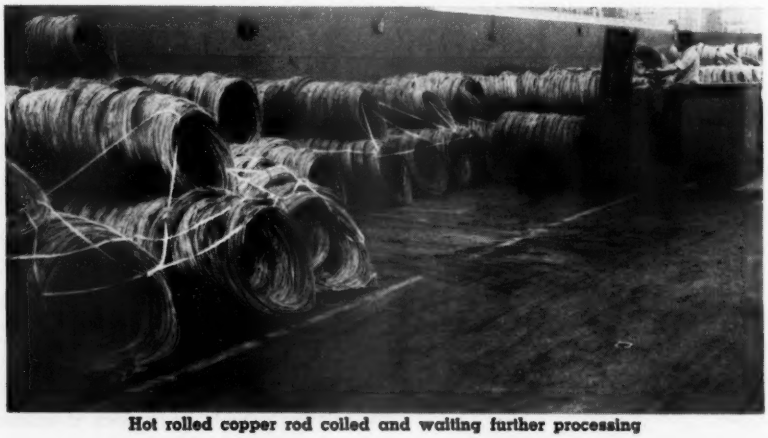
The United States primary production for the year is estimated at 935,000 tons; secondary production is estimated at 118,000 tons, making a total estimated production of 1,053,000 tons, which is greater by 16 percent than the 1949 total. Refined production will probably amount to 1,265,000 tons, which is greater by about 20 percent than 1949. Deliveries to fabricators are expected to total around 1,365,000 tons for the year. Net imports will be close to 490,000 tons. If it were not for the demands for armament and for the Government stockpiling program, the domestic supply of copper during the year would have been enough to supply the high peacetime requirements of this country. With the outbreak of hostilities in Korea in June, extra demands arose as the need for rearmament became apparent. It is very likely that a feeling of possible shortages in hard consumer goods spurred on a public buying wave which, in turn, resulted in building up unfilled orders at the fabricator levels. It became clear that there would not be enough material available to superimpose on an already high civilian production level a large rearmament and stockpiling program. This was also true in some other non-ferrous metals, and by the year end a number of restrictive and limiting orders had been issued by the National Production Administration.

Inventories Down

Stocks of refined shapes in producers' hands dropped from around 110,000 tons at the beginning of the year to approximately 49,000 tons at the year end. The Government stockpiling program took substantial tonnages of copper during the year. This reduced the amount of copper available for current fabrication. Fabricators' stocks, which stood at approximately 355,000 tons at the beginning of the year, were down to 278,000 tons at the year end, a reduction of some 77,000 tons. Copper scrap was purchased by consumers and conversion arrangements entered into under which the resulting refined copper was returnable to the scrap purchaser. In many cases, the net cost to the consumer for such copper was considerably higher than the 24½¢ level. These arrangements caused scrap to be diverted from its normal flow. With the NPA controlling scrap, the normal flow of scrap should be resumed in 1951, and, in this respect at least, a more stable market will result.

Outside of the United States total primary and secondary production increased approximately 80,000 tons over 1949 production to an estimated total of around 1,362,000 tons. Toward the end of the year increased demands for copper abroad appeared, and the year ended with an apparent shortage developing there, accompanied by higher prices being offered for copper than the United States 24½¢ level.

Whether or not further Government controls over the allocations of copper will be forthcoming in the near future is unknown at present. It is very probable that the current shortage of copper will continue during the period of emergency. It is sure that the supply will be channeled first to meet the defense and armament requirements, and second, the essential civilian requirements before any balance is available for non-essential civilian uses.



Hot rolled copper rod coiled and waiting further processing

Lead in 1950

Defense Plans Assure Continued High Demand and Stimulate Production

By GLOYD M. WILES
Manager, Mining Dept.
National Lead Co.

LEAD continued its decline from 12¢ in January to 10½¢ on March 14. During 1949 the price had fluctuated between 12¢ and 15.125¢, following its precipitous drop from the all-time high of 21.5¢ prevailing at the beginning of 1949 to the 12¢ figure reached on May 26.

Imports of foreign lead (ores and metals) reached an unprecedented high of 490,000 tons. This is a 28 percent increase over 1949, which, in itself, was a year of unusually large imports. Currency devaluation and the necessity for American dollars abroad were the principal reasons for these higher imports. Demand, too, played a part, as local production was above any year since 1943.

After the outbreak of war in Korea industrial activity increased, lead stocks decreased, and the price rose to 14¢ on August 21, to 15¢ on September 1, to 16¢ on September 8, and to 17¢ on October 31. Lead stocks at domestic smelters and refineries increased from 201,526 tons on January 1, 1950, to a high of 220,848 tons on April 30. As the lead price became stabilized, manufacturers began to build up stocks, which had been decreased during the period of falling lead prices. This replacement of manufacturers' stocks, along with the increased industrial activity resulting from the war in Korea, gradually reduced stocks at the smelters and refineries to 158,142 tons by the end of October, the latest data available at this writing.

Stocks of refined lead at the primary refineries increased from 76,529 tons on January 1, 1950, to 88,581 tons on March 31, which was the highest of the year. Since that time stocks have steadily decreased to 50,854 tons on November 1. In addition, stocks of antimonial lead at primary refineries decreased from 9,095 tons on January 1 to 8,214 tons on November 1.

Domestic mine production was expected to be about 425,000 tons in 1950, or slightly higher than in 1949. The largest increase in production for the first nine months of 1950 came from the Idaho, Montana and Washington area, which averaged 34 percent more than 1949 production. Southeastern Missouri was eight percent higher than in 1949, whereas Arizona, Colorado and New Mexico decreased production about 12 percent. It is pertinent to point out that production in Idaho, Montana and Washington was adversely affected by strikes during 1949, accounting for at least a part of the large increase in 1950 when no major interruptions of production occurred.

Consumption of lead in the United States was expected to be about 1,200,000 tons during 1950. All the lead consuming industries show increases. The storage battery industry, the largest single consumer, was expected to use 400,000 tons of lead, or 42 percent more than in 1949. The cable covering industry, the second largest consumer, was expected to use approximately 140,000 tons, a slight increase above 1949 figures. The paint industry, the third largest consumer, was expected to use 125,000 tons in 1950, which is an 81 percent increase over the previous year. Solders were expected to increase 62 percent; caulking materials, 77 percent; building construction, 39 percent; and ammunition, 83 percent.

Mining

The record imports of lead ore and metals have had a very sobering effect on the domestic lead mining industry, and most of the mining companies are attempting to reduce their costs in every possible way to meet this foreign competition. In the Tri-State, southeastern Missouri, and Illinois fields costs are being reduced by re-

TABLE I UNITED STATES LEAD SUPPLY AND DEMAND BASED ON LIA, USBM AND ABMS DATA

Supplies from	1949	Estimated 1950[1]
Domestic ores	409,908	425,000
Foreign ores and base bullion	109,713	70,000
Secondaries	384,023	380,000
Imports of metal	275,240	420,000
Total receipts	1,178,884	1,295,000
Inventory of lead stocks at primary smelters and refineries:		
On January 1	146,754	201,500
On December 31	201,526	160,500
Change	+54,772	—41,000
Total supplies used	1,124,112	1,336,000
Consumption[2]	868,450	1,200,000
Inventory of consumers' stocks on January 1	97,165	76,900
Inventory of consumers' stocks on December 31	76,920	69,900
Change in consumers' stocks	—20,245	—7,000

[1] Based on receipts of first nine months and estimates for remaining three months of 1950.
[2] Does not include lead purchased for Government stockpile.

TABLE II UNITED STATES LEAD CONSUMPTION BY INDUSTRIES BASED ON LIA DATA

	Short Tons		
	1949	1950[3] Estimated	Change from Previous Year
White lead	20,600	35,000	14,400
Red lead and litharge[1]	48,600	90,000	41,400
Storage batteries	280,600	400,000	119,400
Cable covering	130,100	140,000	9,900
Building[2]	48,200	67,000	18,800
Tetra-ethyl	101,700	110,000	8,300
Ammunition	18,000	33,000	15,000
Foil	2,700	3,000	300
Bearing metal	26,600	32,000	5,400
Solder	58,300	95,000	36,700
Type metal	25,000	31,000	6,000
Caulking	33,800	60,000	26,200
Other uses	73,800	104,000	30,200
	868,000	1,200,000	+332,000

[1] Exclusive of oxides for storage batteries.
[2] Chiefly pipe, sheet and extrusions; includes lead used in chemical construction.
[3] Estimate based on actual consumption of first nine months of 1950.

TABLE III IMPORTS OF LEAD INTO THE UNITED STATES (LEAD CONTENT)

Country	1949 Monthly Average (12 Mos.) Ore and Matte	Bullion or Base Bullion	Pigs and Bars	Total	1950 Monthly Average (9 Mos.) Ore and Matte	Bullion or Base Bullion	Pigs and Bars	Total
Canada	861	...	4,703	5,564	842	...	7,439	8,281
Mexico	698	2	10,533	11,233	234	...	18,586	18,820
El Salvador	...	...	...	...	40	...	...	40
Guatemala	243	...	...	243	9	26	...	35
Honduras	...	...	...	...	36	...	...	36
Bolivia	1,761	...	...	1,761	793	...	...	793
Chile	530	...	...	530	284	...	...	284
Ecuador	...	...	...	...	34	...	...	34
Peru	1,248	9	2,887	4,144	1,210	...	2,598	3,808
Belgium	...	...	18	18	...	...	...	...
Germany	...	...	694	694	...	...	894	894
Italy	...	...	285	285	...	...	...	...
Netherlands	...	...	18	18	...	...	30	30
Spain	...	...	...	...	...	...	...	...
United Kingdom	...	...	...	...	...	...	5	5
Yugoslavia	...	...	1,953	1,953	...	...	3,494	3,494
French Morocco	765	...	...	765	...	...	...	...
Union of South Africa	1,846	...	...	1,846	1,198	...	...	1,198
Australia	749	187	1,433	2,369	735	255	1,431	2,421
Burma	31	...	118	149	...	...	...	...
Japan	...	...	176	176	...	102	572	674
Philippines	23	...	...	23	85	...	...	85
Korea	43	...	4	47	...	...	...	...
Other countries	148	...	117	265	23	6	4	33
Total	8,946	198	22,939	32,083	5,523	389	35,053	40,965

placing track haulage with Diesel trucks and by increasing mechanization. Self-propelled drill Jumbos, Eimco tractor loaders, Joy loaders, Diesel road building machinery, Diesel tractors, Diesel trucks, and shuttle cars have been installed to replace some of the column drilling, scraper loading, and locomotive haulage equipment. In the Illinois field this has been supplemented by an inclined trucking roadway from the mine level to the surface to eliminate hoisting. In the Northwest, an inclined tunnel for the accommodation of a conveyor belt and tractor haulage was installed from the mine level to the mill. The conveyor transports the ore; the tractor hauls supplies underground.

Metallurgy

The Consolidated Mining and Smelting Co. of Canada's Sullivan concentrating plant added sink float equipment to upgrade the minus 1½-in. plus 4-mesh size fraction of ore. This represents 72 percent of the mill feed and averages 7.1 percent lead and 6.3 percent zinc. The float product produced was 24 percent of the mill feed and averages 0.19 percent lead and 0.29 percent zinc. This material was returned to the mine and used as backfill. The sink product, amounting to 48 percent of the mill feed, averages 10.6 percent lead and 9.1 percent zinc, and is subsequently ground to minus 28-mesh size for concentration by flotation. While dollar values were not assigned, it is stated that the introduction of float and sink has proved to be a definite benefit, yielding excellent dividends in reduced wear, finer grinding, and improved over-all metallurgy.

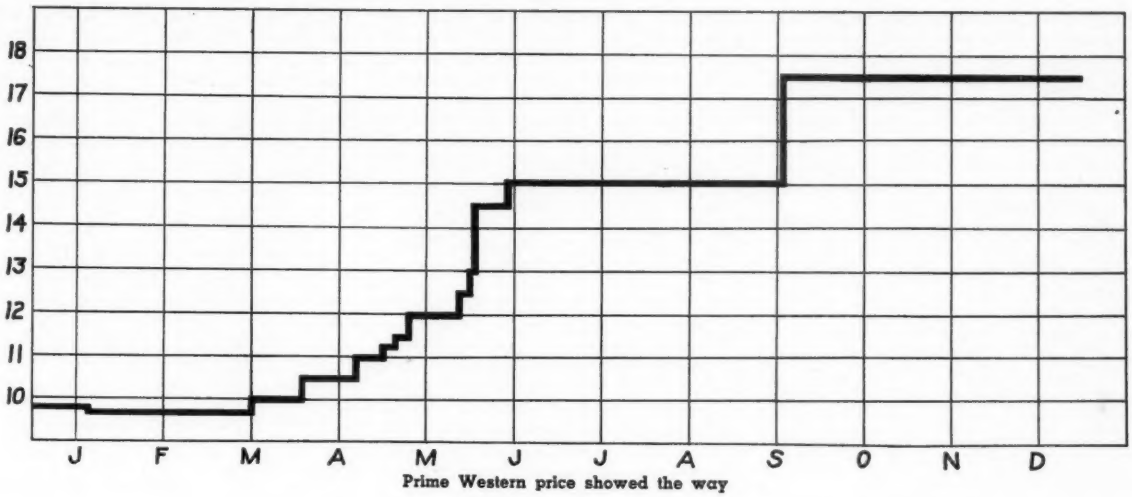
Experiments on the design of lead blast furnaces and the size of materials in the charge have been carried on for a number of years at the Broken Hill Associated Smelters at Port Pirie, South Australia, and these data were published in the October 1950, edition of the *Journal of Metals*. The installation of two rows of tuyeres, additions to the width, length and height of the furnace, and the introduction of semicircular in place of rectangular ends have increased the furnace efficiency materially. Daily production increased from 291 tons on the old furnace to 586 tons on the latest model.

Anaconda Wire and Cable has developed a new lead alloy for cable sheathing that has a higher resistance to fatigue and hoop stresses. Creep resistance is fairly important in the life of cable sheathing, and this new alloy has improved lead's position in this field.

National Lead Co. has developed a lead alloy known as Nalco metal, which is highly corrosion resistant, for use in anodes, coils and linings in chromium plating and similar installations where corrosion is a factor due to oxidizing conditions. In most electroplating systems the metal being plated is used in the anode because the rate of plating and the solution of anode are equal. In the case of chromium plating, the rate of solution is about ten times faster than rate of plating. This throws the whole solution out of balance as a chromium anode is unable to reoxidize the chromium chromate, formed at the cathode, to chromic acid. Normally, an insoluble anode has to be used and chromium salts supplied by adding chromic acid to the solution. By using Nalco metal none of the above precautions are required. The increased corrosion resistance has been gained at no expense of the desired physical properties.

The outlook for lead in 1951 appears good. Imports are expected to remain at a high level, but present plans for defense should maintain high level demand for lead for many months to come.

Trackless mining machinery, often Diesel-powered, helped cut costs



Prime Western price showed the way

Zinc

As "Price" Goes—So Goes the Zinc Industry

By R. J. MECHIN
Assistant to Vice-President,
St. Joseph Lead Co.

WITH minor variations the story of zinc in 1950 is told by the above curve. From gloom through nearly the entire first quarter, to cautious optimism well into the second quarter, the picture rapidly changed to one of a scramble for concentrates and revisions of production goals during the remainder of the year.

It is worth noting here that zinc had reached the then seemingly high price of 15¢ "before Korea" and that the subsequent rise to 17½¢ and maintenance of that figure was a masterpiece of self-restraint on the part of producers and of cooperation with the government's expressed wishes. This was in the face of foreign metal selling at from 1-5¢ above the U. S. market, with all shipping charges for buyers account. Reported gray market sales above 30¢ per pound were not uncommon.

1950 Consumption

The American Zinc Institute estimates U. S. production of slab zinc in 1950 at 910,000 tons, of which 850,000 tons went to domestic consumers and 20,000 tons were exported. The remaining 40,000 tons, plus 85,000 tons drawn from smelters' stocks were absorbed by government stockpiling. Add to this the 150,000 tons of imported metal and total deliveries reach the record-breaking figure of 1,145,000 tons!

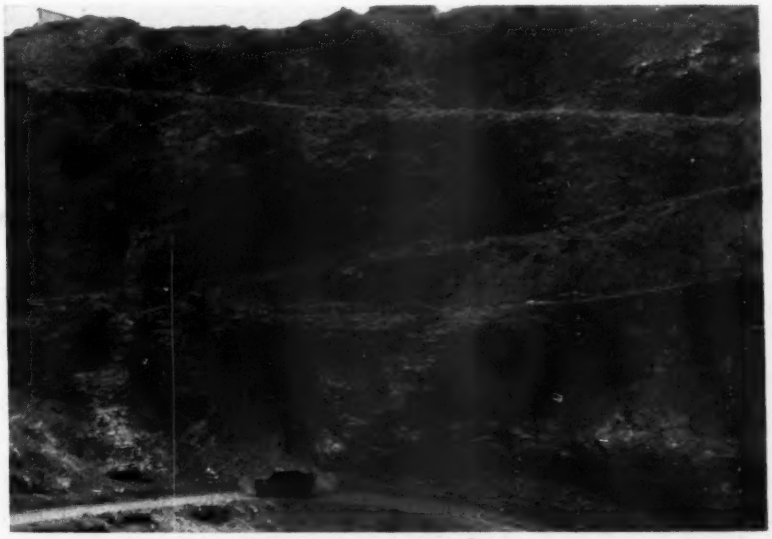
At the Mines, Mills and Smelters

Low metal prices in the early part of 1950 caused a reduction of labor forces and a decrease in the hours worked at some mines and the closing of one small producing mine in the eastern area. Strikes at Palmerton at the beginning of the year and later at Austinville also contributed to some curtailment in production.

By the end of the year, however, all remaining plants were operating at full capacity and a mine producing about 1000 tons of concentrates per month was reopened in East Tennessee in August.

Rather extensive expansion programs are under way in the eastern area. In northern New York production of concentrate is expected to increase by 25 percent by the end of 1951, and a new mine producing some 1000-1200 tons of concentrate per month is scheduled to come into production in East Tennessee in the coming year. Longer range projects for sizable increase are being vigorously pressed at Friedensville, Pa., and Jefferson City, Tenn.

In the Tri-State area the pattern was repeated with recoverable zinc


Much zinc comes from small mines

production increasing from a monthly average of 5782 tons in the first quarter to 8042 tons in the third quarter, and no doubt a further increase will be shown for the final quarter of 1950. Several mines were reopened and at least one mill resumed operations.

There was a considerable step-up in production from southeast Missouri beginning in October.

The northern Illinois-Wisconsin field held its output steady during 1950, with one mining company resuming production in December.

Considering the "Western" area as that west of the Tri-State District, a typical pattern emerges in most sections, i.e., low prices early in the year kept production down, strikes also played their part; later, better prices permitted reopening some closed mines and stimulated increased production in the remainder.

In Montana one small mine reopened and production of concentrate increased by the year end to a rate 3500 tons per month above the 1949 average, with a further expansion of 500 to 1000 tons per month expected in 1952.

Zinc production in Utah was particularly hard hit by low metal prices, plus strikes and a mine fire, all of which contributed to reducing the output of concentrate for the year to about two-thirds of normal. By the spring of 1951 full production is expected and additional output from two new mines now in the exploration-development stage is possible. Nevada's production was approximately unchanged and no great increase is forecast for the coming year although a new flotation mill is scheduled to start early in 1951 and expansion of other facilities for treating complex ores is contemplated.

Several mines in the southwestern states were re-opened during 1950 and should add over 3000 tons of concentrate per month to the supply. Offsetting this, however, a former large producer's output dropped approximately 7000 tons of metal in 1950 as compared to 1949, and will decrease an additional 19,000 tons in 1951. Strikes played their part in reducing production.

In Colorado there were no noteworthy suspensions of operations and no new large scale operations were started; the most noticeable change being renewed activity on the part of small leasers. One sizable mine was re-opened and a mill expansion of 50 percent by one producer in the San Juan District is likely to be in operation by mid-1951; another mining company in the same area will increase output by 20 percent.

Far western properties, in California, are operating at full capacity with no marked increase in tonnage contemplated. Three mines resumed production in August.

In the northwestern part of the "Western" area strikes and low prices kept many mines closed until mid-year when a marked revival took place, although increased production was slow to materialize until the end of the year. No new mines were reported opened and contrary to most surmises only a small increase in production is forecast for 1951, but a substantial increase should occur in 1952.

Price Increase—Production Lag

A point often raised by non-miners is, "why does production lag when the price has increased?" Lost sight of is the fact that many zinc mines are run by small operators with limited or insufficient working capital. When prices are low these miners are forced to discontinue development and concentrate on mining higher grade ores in order to survive. Then when higher metal prices do arrive, they are forced to mine below average grade ore and invest cash in development programs to provide some reasonable ore reserve. A cycle like this can result in an extensive period of low output. Instead of curtailed buying during low metal prices and increased purchases when metals are scarce and prices high, a realistic policy in buying for government stockpile would have obviated much of this condition.

Smelter Modernization and Expansion

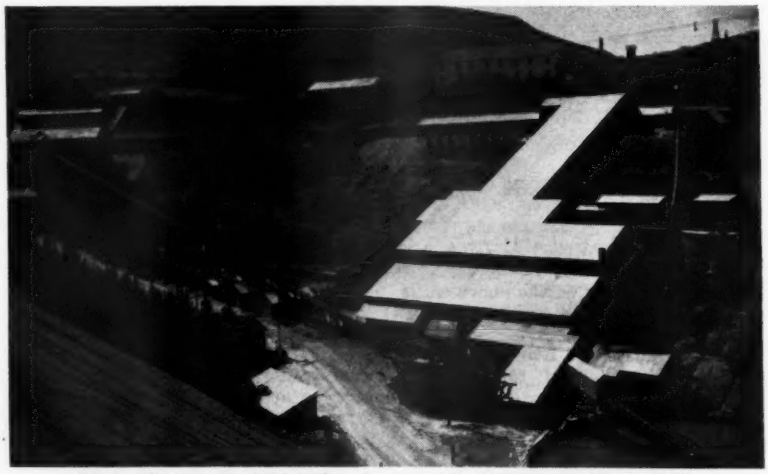
During the year the last of the horizontal retort furnaces at Palmerton were replaced by vertical retorts with the recently developed "splash condenser." This change resulted in a reported improved recovery and higher productivity per retort. Modernization programs of varying degrees have been completed or are well under way at practically all prominent smelters but only one definite increase in smelter productive capacity, from 150 to 200 tons of metal per month, is reported for the coming year.

Any criticisms of this condition can be simply and effectively stilled by the question, "Where will the concentrates come from?" as will be noted later.

New Beneficiation Development

A new development in the electrolysis of zinc for the production of low-lead slab zinc is reported, but no details are available. Progress was also made in the purification of electrolytic plant zinc liquor by copper-arsenic addition. The development of an electro-thermic furnace for the recovery of zinc from lead blast furnace slag has advanced beyond the experimental stage.

A leaching process for oxide zinc ores is in the research stage and if successful will affect many desert areas in the west where small deposits of this type of ore occur.



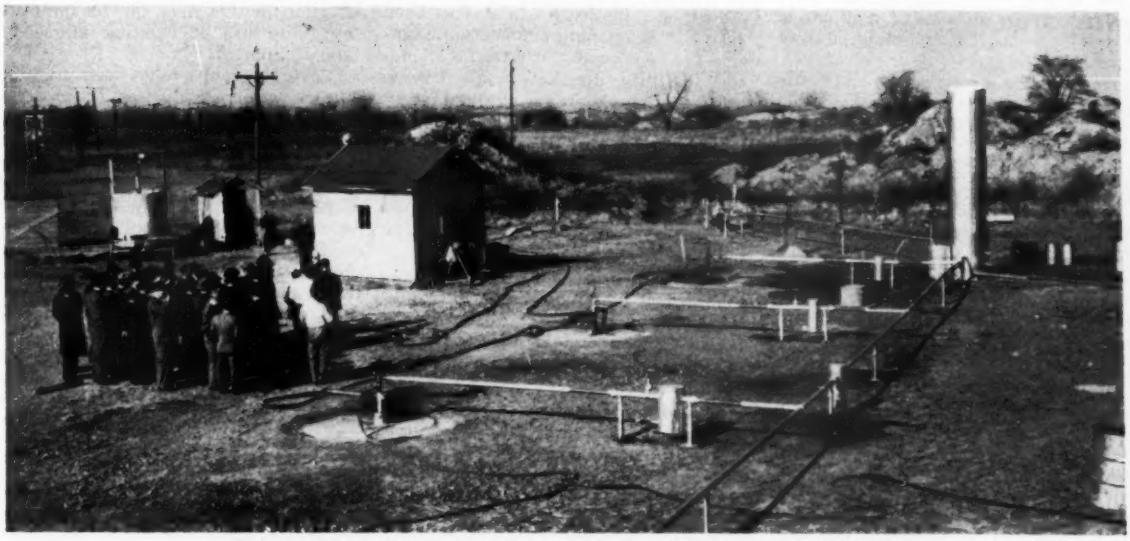
Mines idle in early 1950 will be back in full production by Spring 1951

Output Requires Manpower

A problem that seems to haunt all operators, based on bitter World War II experience, is that of maintaining an adequate supply of experienced labor. At the end of the year the eastern area was the least affected, with western states the hardest hit, particularly in the mines—the base of all metal production.

Unless the government acts rapidly and comes up with a realistic, common-sense program, a curtailment in the production of metals will occur. Maximum output cannot be maintained if pirating by defense plants with their "cost plus" wages is permitted while the mining industry may not be able to operate on the same basis. Neither can the industry stand the drafting of men who, although only 25 years of

(*Continued on page* 68)



Underground gasification of coal by electric current demonstrated in Missouri

Coal Research

Major Efforts Develop Basic Information and Equipment for Solid Fuels Utilization

By J. W. IGOE and H. J. ROSE

Respectively, Technical Editor and Vice-President and Director of Research Bituminous Coal Research, Inc.

IN order to report on current coal research, the authors sent questionnaires to 192 associations, research institutions, universities, and private companies known or assumed to be conducting research on the nation's primary mineral fuel. Information about the research activities of the U. S. Bureau of Mines and coal research in England, France, The Netherlands, and Germany was developed by private communications and from current literature.

Of the 192 groups surveyed, 102 returned questionnaires. Forty-two provided usable information on 333 research projects conducted last year on coal's occurrence, properties, production, utilization, and conversion. One hundred and nine projects were fundamental research; 224 were devoted to engineering and development work.

Twenty-nine of those reporting their research activities also provided information about research expenditures. An expenditure of $3,568,161 financed 225 of the projects. Because of company or organization policy the remaining groups did not report on specific projects or finances. In addition, USBM in the fiscal year ending June 30, 1951, will spend $5,000,000 on the production of synthetic fuels from coal, and an additional $1,700,000 on other coal research. These figures do not include the collection of statistics and economic information, nor coal mine inspection and educational safety work.

It is known that coal research is being conducted by organizations which, for business reasons, did not make information available. Therefore, this article is not complete. It contains, however, as comprehensive and recent information as is currently available. It is regretted that space does not permit identification of all the sponsors of projects summarized.

Properties

American research groups exclusive of the Government conducted research on coal structure, composition, chemical and physical properties, and new methods of coal classification. There were 17 fundamental studies on the nature of coal to assist in using coal more effectively in known processes, and to aid in the development of new processes.

Production

MINING—Continuous mining machines and auxiliary equipment continued to be a major subject of research and development, and more than 100 continuous miners are now in use. The Mining Development Committee project of Bituminous Coal Research, Inc., developed a different mining principle, and completed the assembly of a test unit. This project also demonstrated an extensible face conveyor and the application of stainless steel to conveyor belts.

Projects by other groups studied the value and application of roof bolts in order to permit greater mobility of mining equipment underground and for other advantages. Basic studies of roof and pillar action were made in

Analyzing air for fire damp in laboratory of "Cerchar," France

order to learn causes and methods of controlling coal mine pillar bursts. Causes and control of mine roof deterioration were considered, and methods for evaluating and allaying dust in mines were studied.

Development of underground mining equipment for bituminous and anthracite coal mines continued. This equipment included locomotive batteries, cutting machines, loading machines, belts, and shuttle cars. Drills for coal production and for coal prospecting were developed. An investigation of the cutting action of a water jet up to 1000 psi on bituminous coal was made with negative results.

WASTE DISPOSAL—Waste disposal projects were related to: the formation and control of acid mine water and economics of proposed treatments, the causes and control of gob pile fires, and strip bank rehabilitation.

COAL PREPARATION — Activity in coal preparation research continued along with the growth in mechanized mining. Equipment manufacturers have been engaged in developing vibrating screens for screening fine coal, dry cleaning of coal, washing equipment, and coal drying. Dense media systems have been evaluated. Study has been given to increasing the efficiency of float and sink processes through the development of more efficient equipment. Preparation research included a fundamental study of dewatering and drainage phenomena in coal preparation.

Prediction of final moisture content as a function of specific surface appears feasible as a result of a study of the operation and particle distribution variables on screen type centrifuges.

Pumps for sludges and slurries have been improved, and the economics and process advantages have been shown for the liquid-solid cyclone in the desliming of fine coal slurries.

Experimental work on a process to desulfurize coal will continue in 1951.

Utilization

A major portion of coal research being conducted today is concerned with discovering basic information about coal utilization processes and the development of coal-burning equipment.

In fundamental research, petrographic studies were made on coal and associated rock to discover their components in relation to coal utilization. Combustion in fuel beds, pulverized coal combustion, flame speed, and stability were investigated fundamentally. Coke strength, size, porosity, and quality were evaluated.

RESIDENTIAL — Coal utilization research for the residential market was conducted primarily by Bituminous Coal Research, Inc., and the Anthracite Institute. BCR has been active in developing smokeless, magazine-type equipment at Battelle Memorial Institute. Smokeless space heaters are commercially available and hundreds are in successful use. Smokeless furnaces and boilers are undergoing field trial. Laboratory versions of the BCR fully-automatic downflow stoker-boiler unit are being redesigned to provide production-type units for field trial.

The Anthracite Institute's Anthratube stoker-boiler unit and Anthraflo stoker-boiler and stoker-furnace units are being commercially manufactured. In both cases, ashes collect in a bushel can in the base.

Bituminous, anthracite and coke groups continued the joint sponsorship of research on (a) ash removal from residential equipment, and (b) improved designs for homes heated with solid fuels. Complete construction blueprints for such homes are available.

LOCOMOTIVE AND MARINE—The major coal research project in the motive power field is the development of the coal-burning gas-turbine locomotive under the Locomotive Development Committee of BCR. This program has already added much knowledge to basic coal utilization technology by its investigations of burning pulverized coal under pressure at high heat release rates, its work on efficient fly ash removal from hot high-velocity gases, and its general development of the coal-burning gas-turbine. The various full-sized equipment components are being combined within the space limitations of a locomotive for stationary tests. In addition, BCR and several railroads are conducting research on cinder collection and disposal from steam locomotives. An increasing number of railroads are recognizing the relation between fuel size and performance.

Cooperative research begun in 1950 is actively proceeding on air pollution abatement from Great Lakes vessels.

INDUSTRIAL—Coal utilization research for industrial plants during 1950 stressed basic studies on pulverized coal combustion and engineering and development work on smoke and fly ash control. Associated with this has been a consideration of the economics of fly ash reinjection. The development of a small coal pulverizer of novel design has reached the field-trial stage.

The coal-burning gas turbine referred to above has important possibilities for the stationary generation of power.

Research groups and equipment manufacturers were active in regard to improved and automatic steam generators for small plants. A representative committee is considering methods whereby bituminous coal utilization in this field can be improved by fuller use of existing knowledge and equipment.

Several groups have been studying the injection of slurries of coal and water into combustion and gasification equipment. Ignition, combustion, and ash removal are said to be no more difficult than with dry pulverized coal.

SPECIAL USES—Work continued on non-fuel uses of coal, mine refuse, and fly ash. The products include activated and other special carbons, fertilizers, aggregates for concrete, and the use of fly ash in concrete, bituminous highway materials and thermal insulation. Fundamental research into the coal molecule is adding to the technology of coal and is disclosing new raw materials for the chemical industry.

Coal Conversion

Sixty-nine projects were reported by groups other than the U. S. Bureau of Mines on transforming coal to other products, i.e., by gasification, by-product coking, liquefaction, and chemical treatments.

A technical and economic survey of the entire field of fuel gas from coal was released in book form by BCR during 1950. One result of this study is a cooperative project to develop improved gas producers. Gasification reactions in fluidized systems and in beds are being investigated for both bituminous coal and anthracite by various groups. Sinclair Coal Co. and the Missouri School of Mines have announced an electrocarbonization method of underground gasification, which utilizes electric current for opening a channel in a coal seam between electrodes. Producer gas may be obtained by passing air through this channel.

A book, "Coal, Coke and Coal Chemicals," was authored by members of a Carnegie-Illinois Steel Corp, Fellowship. Eastern Gas and Fuel Associates have improved the efficiency of coal chemical recovery and correlated laboratory methods for determining chemical yields with production records; have developed a method of disposal of carbonizing plant effluents, and have made improvements in the utilization of safe coal mixes for maximum coke and gas yield. Various groups are actively working on the products obtained by the carbonizing of coal. This includes identification, analysis, properties and uses of constituents, processes for recovery and purification, plant waste disposal, and synthetic derivatives of coal products.

One phase of the work of the Carnegie Tech Coal Research Laboratory is the direct conversion of coal to a wide variety of chemical products by controlled oxidation or by stepwise hydrogenation, and the study of the resulting products. The role of coal sulfur in hydrogenation is also being

investigated. Coal oxidation has also been studied at Penn State and Alabama State.

USBM Coal Research

Research and development on synthetic liquid fuels processes comprised 75 percent of Bureau of Mines coal research during the year 1950, with 25 percent of the research being concerned with mining and coal utilization problems other than synthetic fuels.

The Bureau of Mines considers increased coal recovery and efficiency as primary needs, and continued to study the mechanized extraction of pillars underground, the development of mechanical equipment and new methods of roof support for anthracite mining. The anthracite laboratory at Schuylkill Haven, Pa., was completed.

As part of its safety program the Bureau conducted research on exhaust gases from Diesel engines used underground, collected data and evaluated effectiveness of methods of controlling dust and mine fires, tested mine atmospheres for toxic constituents, and completed studies on the determination, collection, and dissemination of mine dust.

The Bureau's study of coal preparation included testing of the cyclone thickener for fine coal recovery. Preparation characteristics of Illinois, Pennsylvania, Tennessee, and West Virginia coals were determined. Research was conducted on the preparation of coal for use in synthetic liquid fuels processes.

Development continued on feasible methods of utilizing the vast reserves of low rank Western coals. Improvements on drying processes give promise of off-setting high moisture contents of these coals. Earlier quantity-storage of lignite in North Dakota was continued successfully. The lignite research laboratory at Grand Fork, N. D. was completed.

Fundamental research on coal combustion provided information about corrosion of furnace wall tubes and of factors affecting heat absorption in furnaces.

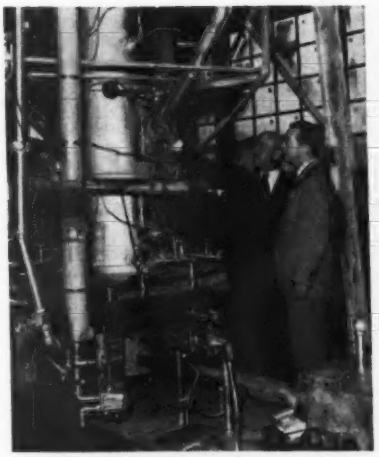
Depletion of coal suitable for metallurgical cokes continued to be a matter of concern, and much attention was devoted to various aspects. A systematic study of the coking-coal reserves of the United States is in progress. Carbonizing properties of American coals and blends of coals are being studied to determine their suitability for making metallurgical coke.

The Bureau continued its underground gasification project at Gorgas, Ala.

Synthetic Fuels

The Bureau of Mines reports satisfactory progress in its program leading to the production of synthetic fuels from coal. Pilot plant production of synthetic gas by the gasification of pulverized fuel was successful, and a new pilot plant permitted testing of various types of coal to determine their value in making synthesis gas on a commercial scale. This research also considered the purification of synthesis gas in the production of synthetic liquid fuels. Facilities for research on synthesis gas at Morgantown, W. Va., are to be expanded.

Paralleling these investigations, attention was devoted to laboratory and pilot-plant study of the hydrogenation of coal to produce liquid fuels. Valuable data were obtained on the action of solvents on coal, on the reaction mechanism of catalysts in coal hydrogenation, on operating variables, on the hydrogenation of coal in the absence of solvents, on the separation and identification of the products of coal hydrogenation, on the characterization of coal, and on the application of the hydrogenation principle to carbon monoxide produced from coal. Research on the use of metallic oxide catalysts in this process was particularly comprehensive.



Experimental fluidized-bed gas producer burns waste anthracite silt

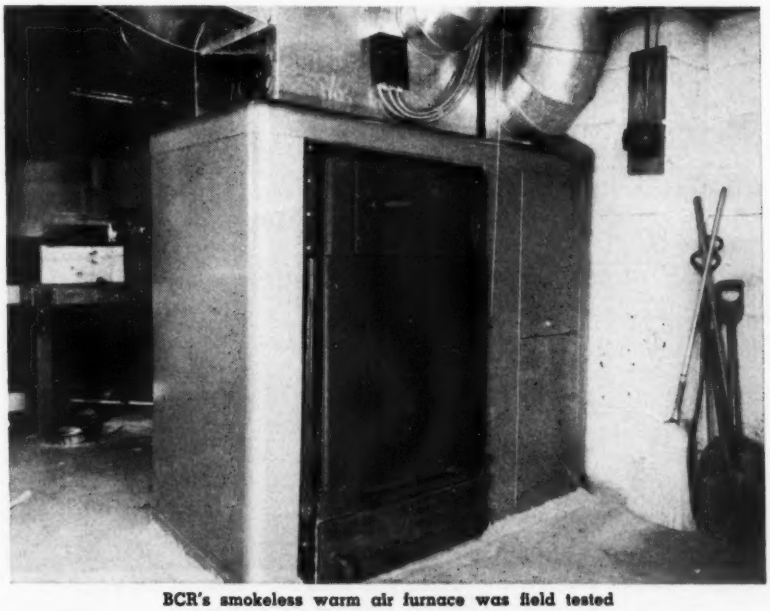
At Louisiana, Mo., the Coal Hydrogenation Demonstration Plant was completed and went through break-in procedures. The Gas Synthesis Demonstration Plant was practically complete and several of the units within the plant were successfully operated. Much interest was shown in the economic aspects of these processes.

Coal Research Abroad

Coal research has actively continued in many other countries, but space limitations permit mention of only a few.

ENGLAND—Research and development work has continued at the Fuel Research Station, Greenwich, of the Department of Scientific and Industrial Research. The station's work to date has been on coal survey, coal preparation, carbonization and gasification, boilers and furnaces, combustion for gas turbines, oils and chemicals from coal, domestic heating and cooking, atmospheric pollution, miscellaneous investigations and war work. The Coal Survey laboratories and staff were transferred to the National Coal Board in 1947, likewise coal preparation work at the station has been reduced to fundamental problems and special investigations.

The British Coal Utilization Research Association (B.C.U.R.A.) at Leatherhead, prosecutes utilization researches in the industrial and domestic fields, and fundamental work on coal structure. The National Coal Board is a major contributor, and there are more than 100 manufacturer members.



BCR's smokeless warm air furnace was field tested

Examples of projects are solvent treatment of coal, smokeless domestic appliances, recirculation of flue gases, flue deposits in water-tube boilers, instrumentation for fuel technology, cyclone combustion for gas turbines, correlation of coal rank and size consist with boiler performance, heat transfer in boilers, and gas producer operation. A book, "Progress in Coal Science," consisting of 26 review articles by staff members was published in 1950. The main section headings are:—modern experimental techniques, fine particles, the constituents of coal, organic chemistry of coal products, and chemical aspects of combustion and gasification.

Safety in Mines Research and Testing Branch conducts diversified research on safety in mining and transport.

British Coke Research Association (B.C.R.A.) conducts work on carbonization problems and potentialities, and on coke quality.

Ministry of Fuel and Power conducts work under its own auspices particularly on gas turbines, utilization of methane in mine, air, and underground gasification.

National Coal Board has a statutory duty to prosecute research on various subjects under the headings of mining, coal preparation, carbonization, briquetting, and coal utilization appliances and processes. The central research laboratory near Cheltenham has facilities for laboratory research and semi-scale trials on the four first-mentioned subjects. The Board is a major contributor to B.C.U.R.A. utilization research and B.C.R.A. carbonization research.

National Coal Board coordinates the activities of research organizations to which it is a principal contributor. In Great Britain there is also a general coordinating committee reporting to the Ministry of Fuel and Power, which is comprised of representatives of all industries active in research on various types of fuel and power.

Gas Research Board at Beckenham has done important research on the complete gasification of coal in various ways, gas synthesis, mechanical breakage of coke, gas plant effluents, etc.

Coal research in Great Britain is proceeding on a scale comparable to that of the United States, and the individual projects are too numerous to list here. Most of the organizations issue annual reports in printed form, which itemize research in progress.

FRANCE—"Cerchar" is the research department of Charbonnages de France, which is a national group of all French coal mines. This research department is a public enterprise, controlled by the government. It has more than 200 employes. All of its activities concern research on coal, its production, utilization, or conversion. Safety studies are being carried forward on explosives, methane combustion, ventilation, gas detection, lighting, use of electrical and Diesel equipment underground, and the physiological action of dust in suspension in the mine. Work was done on coal characteristics and preparation. Investigations were made on the structure and properties of coke, blending coals for the production of suitable metallurgical coke, underground gasification, and extraction of by-products from coal.

NETHERLANDS—Coal research is being carried on by five organizations in Holland. Work is in progress on mechanized mining, rock pressure, ventilation, preparation, utilization, coal constitution and classification, chemicals from coal, firing practice, total gasification of coal, coal chemicals from gas and coal tar, utilization of coke oven gas, and fertilizers. Research is being conducted leading to the improvement of domestic heaters and establishing suitable fuels for this equipment. In addition, domestic heating equipment and industrial heaters are being investigated with the research being confined chiefly to thermal efficiency studies. The Dutch State Mines, with 8,000,000 tons annual output, have two large research laboratories, of which the mining and preparation research stations has 180 employes, and the central laboratory about 425 employes.

GERMANY—During the war, some of the coal research laboratories were badly damaged. Later, research was restricted by the Military governments to approved projects.

Bergbau-Verein (Mining Association) at Essen which formerly conducted much research on coal mining, preparation, carbonization, briquetting, etc., has been dissolved. Its successor, Deutsche Kohlenbergbau-Leitung (German Coal Mining Management) has re-established a number of working committees dealing with mining techniques and economy, mine equipment and standardization, power, and mine safety and rescue work. A coal briquetting committee was very active in 1950.

Reichskohlenrat (Coal Council) at Berlin, which was changed during the war to Reichsvereinigung Kohle, no longer exists. One of its activities had been to act as a steering group to assign coal research projects to appropriate organizations or individuals.

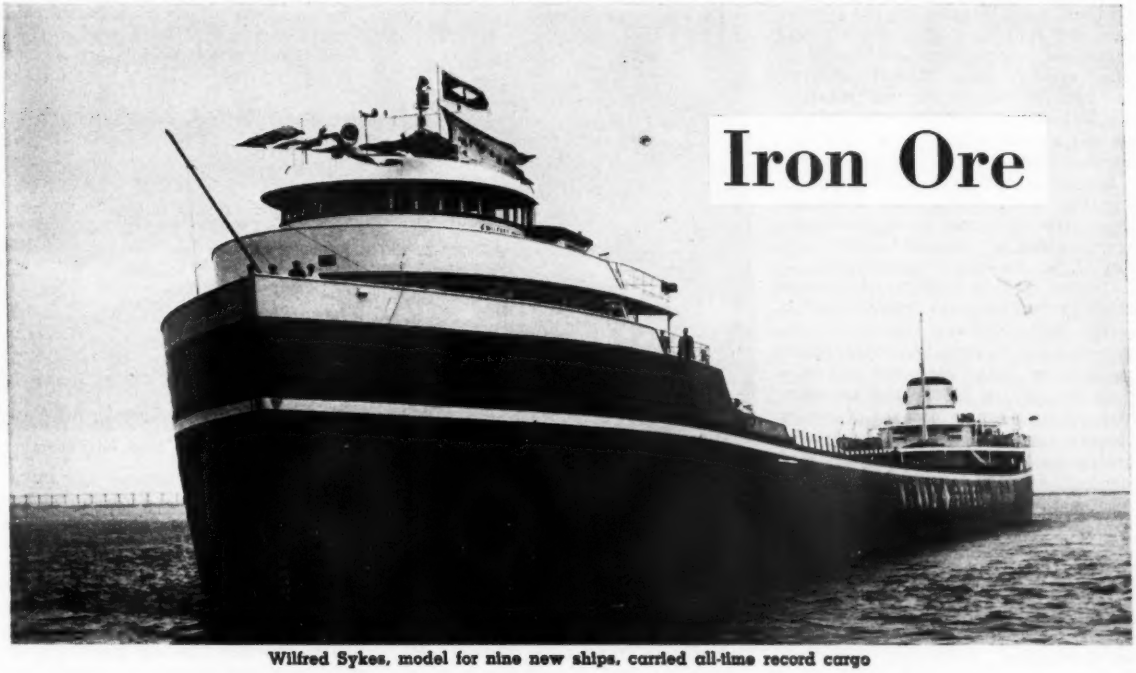
Fundamental coal research is still conducted at Mülheim, Ruhr, in what was formerly the Kaiser-Wilhelm-Institut für Kohlenforschung, but is now called the Max-Planck-Institut für Kohlenforschung. This building was little damaged during the war.

The output of general chemicals in western Germany now exceeds the pre-war level. Negotiations have been proceeding between German interests and the Allied authorities regarding permission to resume the synthesis of certain products from coal such as synthetic motor fuel and synthetic rubber.

An increased tempo of German coal research and industry committee activities is expected. Good coal research papers are beginning to appear.

Central coal research laboratory of Dutch State Mines at Geleen, Limburg, Netherlands

Iron Ore



Wilfred Sykes, model for nine new ships, carried all-time record cargo

Production for Defense Sparks Near-Record Year

By WILLIAM S. CUMINGS
Assistant to General Manager
Raw Material Properties
Bethlehem Steel Co.

APPROXIMATELY 97,500,000 gross tons of iron ore were shipped from the iron mines of the United States in 1950. Although not a record, this total was exceeded only in 1948 and the three war years—1941, 1942, and 1943. Lake Superior mines accounted for 79,800,000 tons or 81.9 percent of the total. Shipments from other producing districts were as follows: Southern states (mainly Alabama, Georgia, Texas and Missouri) 8,600,000 tons; Northeastern states (New York, New Jersey, and Pennsylvania) 4,700,000 tons; and the Western states (chiefly Utah, California and Wyoming) 4,400,000 tons. Table I compares the shipments from these producing districts for the last five years. All districts showed increases over 1949, with both the Western and Northeastern districts making all-time highs.

Domestic shipments were supplemented by imports totaling 8,400,000 tons, which represents an increase of 12 percent over 1949. The three largest shippers, Chile 2,600,000, Canada 2,200,000, and Sweden 1,800,000 tons, accounted for 79 percent of the total compared with 86 percent of the 1949 total. Other important foreign sources were North Africa with 700,000 tons, an increase of 41 percent over 1949, and Brazil with 700,000 tons, an increase of 89 percent over 1949. Minor tonnages were received from Mexico and West Africa. The total imports of 8,400,000 tons were partially offset by exports of 2,200,000 tons, practically all of which went to Canada.

Action on Foreign Ore Front

In Chile, Bethlehem Steel Co. shipped 2,600,000 tons to the United States from Tofo mine, and started preliminary construction at Romeral ore deposit south of the Tofo property, with shipments scheduled for 1952 or 1953. The first cargo of Venezuelan ore was shipped to the U. S. from Bethlehem's Pao mine early in 1951, as substantial stockpiles had been accumulated at the ocean transshipping port at the end of the year. Also in Venezuela, the Orinoco Mining Co., U. S. Steel's subsidiary, announced plans early in 1950 to start immediate development of the new Cerro Bolivar property. The transportation problems in moving this ore from the mine, located 90 miles from the Orinoco River, and another 170 miles from Tidewater, were being studied during the year. This ore deposit is estimated at more than 500,000,000 tons and it is anticipated that shipments may reach 10,000,000 tons a year by 1955. In Liberia, the Bomi Hills deposit, in which Republic Steel Co. has a substantial interest, is approaching the production stage with shipments scheduled for 1951.

Canadian producing districts also participated in major developments last year. The Iron Ore Co. of Canada, the operating company organized by the Hanna and Hollinger interests, together with five domestic steel companies—Armco Steel Corp., National Steel Corp., Republic Steel Corp., Wheeling Steel Corp., and Youngstown Sheet and Tube Co.—announced plans for expenditure of $200,000,000 to develop the Labrador deposits. At the end of the year, actual construction of a 400-mile railroad was under way. Facilities for shipping the first of the estimated 400,000,000 tons of ore will be ready by 1955, and it is expected that yearly shipments will be 10,000,000 tons by 1957.

At Steep Rock Iron mines, which shipped 1,200,000 tons in 1950, a new shaft for underground mining operations at the present "B" open pit, and dredging operations to uncover the "A" orebody were both under way. Inland Steel Co. optioned a large acreage above "C" orebody and if drilling proves successful, this portion of the lake-bed will also be dredged for a third open pit. At the Helen mine in the Michipocotin district, open pit op-

erations were terminated, but production was continued from the recently developed underground extension of this orebody. Also, renewed interest has been shown in the old iron-mining districts of southeastern Ontario, where two properties were being diamond-drilled.

Recent acceleration in ore imports, together with anticipated increases from properties now being developed, has resulted in increased activity at two U. S. ore-importing centers. In Baltimore Harbor modern efficient ore handling facilities are being installed by the Baltimore and Ohio R. R. for transhipping foreign ores to consuming centers in the east and the Ohio River Valley. In 1950 plans were announced for the development of a port terminal at Mobile, Ala., to handle foreign ore transhipment to the Birmingham district.

Puerto de Hierro, Venezuela, tidewater transfer point for iron ore from Bethlehem's El Pao

Lake Superior District

LAKE SHIPMENTS—The 1950 season of navigation on the Great Lakes was hampered by poor weather conditions which seriously interfered with the total lake ore movement. Although the first cargo was loaded at Escanaba on April 19, the ports of Duluth-Superior, which normally handle about 60 percent of all Lake shipments from U. S. ports, were not open to navigation until May 1, the latest date at this port since May 2, 1936. Shipments to June 1 were 5,700,000 tons less than the average shipments to this date in the previous ten years.

A new ore carrier, the Wilfred Sykes, owned by Inland Steel Co. made her maiden voyage in April, and on September 4 at Superior, Wis., loaded an all-time record cargo of 18,929 gross tons—bill of lading weights. By the end of 1950, six companies engaged in lake ore transportation had announced plans to construct nine ore carriers similar to the Wilfred Sykes. Five of them should be ready for the opening of the 1952 ore season.

In addition to 76,300,000 tons shipped via the lakes, approximately 3,500,000 tons were moved all-rail, and 1,500,000 of these tons were shipped from the Mesabi Range to the Youngstown-Pittsburgh district. Despite this record all-rail shipment, total stocks at furnaces and lower lake port docks were estimated December 31 at 35,200,000 tons, the lowest in the last 14 years. With steel operations at near capacity, estimated stocks May 1, 1951, may be well below the record low of 13,500,000 tons in 1947.

OPEN PIT MINES—Practically all open pit mines carried on extensive stripping programs during the winter months. Efficient earthmoving equipment, together with the application of new mining and ore-beneficiation methods, has prolonged the life of many of the Mesabi open pits. These two factors have also given increased impetus to the conversion of many former underground reserves into open pits. In 1950, as in the last few years, most of the large new stripping programs were started at inactive underground properties. Small beneficiating plants were installed at a number of open pits to upgrade the low-grade ore remaining in the present pits or to treat old lean-ore dumps. These new plants utilized straight washing in some cases, but there were installations using the heavy-media process, jigging, and other gravity methods. Many of these newer installations were toward the east end of the Mesabi range, which for many years had shipped practically all direct-shipping, or only crushed and screened ore. Test work on the recovery of a usable product from the lower grade ores—particularly in the finer sizes—continued in most of the research laboratories which are now maintained by practically all the larger operators. The low grade ores of the Michigan ranges were also being investigated in some of the laboratories,

TABLE I

IRON ORE* SHIPMENTS BY PRODUCING DISTRICTS OF THE UNITED STATES, IMPORTS AND EXPORTS 1946-1949

District	1946 Millions Gross Tons	1946 % of Total	1947 Millions Gross Tons	1947 % of Total	1948 Millions Gross Tons	1948 % of Total	1949 Millions Gross Tons	1949 % of Total	1950** Millions Gross Tons	1950** % of Total
LAKE SUPERIOR										
Minnesota, Michigan and Wisconsin	59.7	84.5	78.0	83.3	83.5	82.3	69.2	81.5	79.8	81.9
SOUTHERN										
Mainly Alabama, Georgia, Missouri and Texas	6.6	9.3	8.2	8.8	9.2	9.1	8.1	9.6	8.6	8.8
NORTHEASTERN										
New York, Pennsylvania and New Jersey	2.2	3.2	3.8	4.0	4.5	4.4	3.8	4.5	4.7	4.8
WESTERN										
Mainly Utah, California and Wyoming	2.2	3.0	3.7	3.9	4.3	4.2	3.7	4.4	4.4	4.5
TOTAL	70.7	100.0	93.7	100.0	101.5	100.0	84.8	100.0	97.5	100.0
IMPORTS	2.8		4.9		6.1		7.4		8.4	
EXPORTS	1.5		2.8		3.1		2.4		2.2	
Imports as % of Prod. & Imports	3.8		4.1		5.7		8.0		7.9	

* Exclusive of "by-product" cinder and sinter from various sources.
** 1950 partly estimated—final figures not available.
Source—Lake Superior Iron Ore Association, U. S. Bureau of Mines, and others.

with particular attention being given to the study of the silicious and specular hematite formations on the Marquette range.

UNDERGROUND MINES—The underground mines on all Lake Superior ranges were active throughout the year with underground development, shaft sinking programs, and extensive diamond drilling campaigns. On the Mesabi range one large new underground property entered the production list, while a second property was nearing exhaustion with mining expected to terminate early in 1951. Michigan mines showed most of the new action. At the Ironton mine on the Gogebic range, shaft sinking operations expected ultimately to reach 4000 ft were started. On the Marquette range, ground was broken for the new Tracy mine which will eventually produce 1,000,000 tons per year. At the Montreal mine in Wisconsin, a new shaft sinking program was started which will reach the 40th level, 3786 ft below the shaft collar, and will be the deepest in the Lake Superior district. One large new mine, the Mather "B," entered production in late 1950. Shaft sinking at this property was started early in 1947, and although less than 100,000 tons were produced in 1950, production will reach 1,000,000 tons per year.

TACONITES—Interest in taconites continued at a high pace throughout the year. The Erie Mining Co., operating an experimental plant on magnetic taconites, produced finished pellets in sufficient quantities for shipment to Duluth and the Lower Lakes for blast furnace tests. A second large concentrator, also to treat magnetic taconites, will soon be built on the east end of the Mesabi range by the Reserve Mining Co., now jointly owned by Republic Steel Corp. and Armco Steel Corp. It should be in operation by the end of 1952. Both these plants will be used to determine the most efficient flow sheets for large (2,500,000-ton) commercial concentrating and agglomerating plants, and may each ultimately produce up to 10,000,000 tons of concentrate annually.

Construction of a new sintering and nodulizing plant by the Oliver Iron Mining Co., a subsidiary of United States Steel Co., at Virginia, Minn., was started during 1950 for operation in 1951. Although screened ores will be treated at first, the plant will serve as a source for procuring basic information prior to the construction of commercial taconite plants.

In addition to the pilot plants now built or under construction, all phases of the concentration and agglomeration were receiving continued study in the research laboratories of the major operators. Two pelletizing furnaces

Full scale blast furnace tests were run on taconite pellets

were in operation at steel plants during the year. In both cases, effort was given to working out mechanical problems of the pelletizing process, and to determine the factors controlling the production of hard pellets, suitable to withstand the rough handling from mine to furnace, and which would not produce excessive fines in the blast furnace.

Other Producing Districts

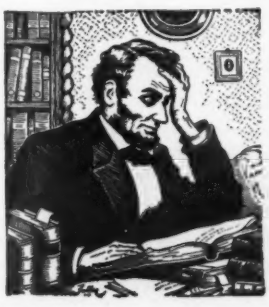
SOUTHERN—Approximately 88 percent of the 8,600,000 tons shipped from the southern states during 1950 was mined in Alabama. Most of the Alabama production, as in the past, came from the Big Seam silicious ore in the Birmingham district. This was augmented by shipments of around 1,000,000 tons from the brown limonite ores of northwestern Alabama and a small tonnage from Georgia. Mechanization continued at most underground operations, with increased emphasis on the utilization of trackless mining equipment, which has proven so successful in the mining of bituminous coal. The beneficiation of these silicious ores, particularly the lower grade material, has continued to receive study in the laboratories of the mining companies and of the United States Bureau of Mines. Only one large scale plant, the Spaulding Concentrator of Republic Steel Co., was operating on these silicious ores in the Birmingham district during 1950. In northwestern Alabama a small heavy media plant was operated throughout the year to beneficiate the lower grade brown ores in this district.

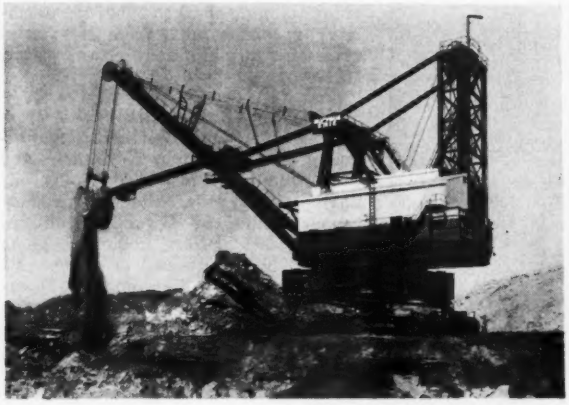
In Texas, the Lone Star Steel Co. announced plans for the acquisition of new mining equipment, and alterations to its beneficiating plant for treating limonite and siderite ores at Daingerfield. The Iron Mountain mine of the Ozark Ore Co. in Missouri was deepening its mine shaft in 1950; the hematite jig concentrates from this property were all shipped to Granite City, Ill.

WESTERN—Total shipments from the three principal producing states—Utah, Wyoming and California — increased 700,000 tons above 1949 to an all-time record. The Sunrise mine in Wyoming shipped around 500,000 tons, about the same as in 1949. The mines of southwestern Utah increased shipments 15 percent above 1949 to 3,000,000, but not an all-time record. California shipments totaled 900,000 tons, an increase of 65 percent above 1949. Practically all of this increase was due to the expanding operations of the Eagle Mountain mine of the Kaiser Steel Corp. Production at this property expanded rapidly early in the year, and was at an annual rate of 1,000,000 tons during the last half of the year.

NORTHEASTERN—The magnetite mines of the three northeastern states, New York, New Jersey, and Pennsylvania, shipped 4,700,000 tons in 1950. The four small underground mines in New Jersey shipped almost 600,000 tons, and the Cornwall mines in Pennsylvania 1,200,000 tons, with the balance of 2,900,000 tons coming from the Adirondack region of New York. In New York state a new small open pit was started near Lyon Mountain to augment production from the Chateaugay underground mines. Benson mines started an addition to the concentrator plant for gravity treatment of the non-magnetic martite associated with this ore.

Early in 1950 Bethlehem Steel Co. announced that it had recently acquired a large tract of land near Morgantown, Pa. An extensive diamond drilling campaign has been in progress at this property during the last eighteen months, and although the presence of iron ore has been indicated, it is not known if the property will warrant development. This property, located in the vicinity of a number of small magnetite deposits, some similar to those at Cornwall, Pa., was acquired following an airborne magnetometer survey.





This giant shovel is a far cry from its steam driven ancestor

Strip Mining of Coal

Industry Continues to Move Forward

By WILLIAM L. BURT
Consulting Engineer
Greenland Coal Corp.

AS 1950 came to a close the Strip Mining Industry again found itself in a position of great importance in our national coal scene. Even burdened by its share of domestic troubles, the over-all picture was good. In spite of car shortages, soft markets and labor disorders in various fields, the industry as a whole advanced in future planning and technique as it has in years of more normal operating conditions.

Total U. S. production for 1950 will be approximately 500,000,000 tons, of which stripping should account for 125,000,000 or 25 percent. It is interesting to note that strip mining has increased its percentage of the U. S. total consistently over the past 10 years. We might say that the war years, 1941-45, accounted for this materially, but since 1945 the increase has been caused mainly by better preparation and acquainting the market with the possibilities of strip coal. Consumers found during the war that they were able to use this coal successfully and as a result of even better preparation since the war years they have continued to burn it in preference to other fuels.

Year	Strip Coal Production	% of Total
1940	43,167,000	9.4
1941	55,072,000	10.7
1942	67,202,000	11.5
1943	79,685,000	13.5
1944	100,895,000	16.2
1945	109,897,000	19.0
1946	112,964,000	21.1
1947	139,395,000	22.1
1948	139,506,000	23.3
1949	106,045,000	24.2
1950	125,000,000*	25.0*

* Estimated.

While 1950, as mentioned above, was a troublesome year from the operating standpoint, in most areas producers were planning ahead as usual. New machinery, better coal preparation and the exploration of new fields all had their share of attention. In the past two decades it has been this constant effort by the operators that put the strip mining industry on the sound basis it enjoys today.

New Equipment

As we all know, radical changes in stripping excavators are made rather slowly and are not often found in the short space of a year. However, one large manufacturer has announced a new walking dragline of 30-yd capacity, carrying a 200-ft boom. In order to relieve excessive tooth pressure in the swing gear assemblies, which has been one of the most important obstacles to overcome in these large machines, this mechanical giant carries four separate swing units. It also carries independent walking motors, a definite improvement over the older types.

The improvement of digging and filling qualities in both dippers and dragline buckets has been quite noticeable this year. The use of alloy steels has again added materially to the physical qualities of dippers and buckets by lightening dead weight with no sacrifice of strength and durability. The use of alloys is only beginning and the future will bring about more investigation in this particular field.

The now famous wheel type excavator, the utopia in stripping equipment because of its minimum lost motion, has seen some constructive improvements. Growing interest in this type of machine is quite evident among bituminous coal strippers and further improvements will be forthcoming. The type of work in which these units are placed in this country differs so vastly from that in which they are used in foreign areas that wheel excavators of American manufacture show only a general resemblance to those manufactured abroad. Foreign experience, therefore, is of little value here except as a guide.

Long-range stripping front-ends for the smaller machines continue to be improved. The fact that a great portion of our available stripping tonnage today lies in hillside or steep contour areas makes the further development of these twin-caterpillar machines a must for all shovel manufacturers. It was these smaller, portable machines that added so materially to the over-all production increase during World War II.

There was little change in haulage equipment although the trend still continues toward larger trucks and improved haulage roads. The construction of all weather haulage roads continues, especially in smaller operations which have been running a comparatively short time. The time-worn phrase, "Your production is only as good as your haul roads," still holds true.

Diesel power in strip mines con-

tinues to grow in popularity, especially in smaller mines where mobility is an important factor. One large manufacturer of Diesel bulldozers and road graders has announced a new power plant for shovels and draglines. This new engine, designated the D386, is rated at 340 hp, at 1200 rpm and is a V12. Installed in a 5W Monighan dragline in Kentucky, the owners report a 30 percent increase in daily production. The 5W now handles a seven-yd bucket instead of the original five-yd and is stripping 40-65 ft of overburden with a 120-ft boom. The special engine arrangement gives the D386 clockwise rotation. The stub shaft of the engine is bolted to the flywheel and connects the engine to the reduction gear through a flexible coupling.

Strip mining machinery is usually made in the field. Many modern developments have come from the thoughts of those operating the machines on the job. A recent development of particular interest is the Hi-Level drilling machine built by the Powhatan Mining Co. for use at the Betsy mines in Ohio. The idea, originating at Hanna Coal Co.'s Georgetown No. 12 mine, came to Powhatan in late 1949. Using a standard Bucyrus-Erie 29T drill propelling mechanism, the shop at Betsy mine did the rest. A McCarthy horizontal, electrically powered drill is mounted on the platform. This 7½-in. drill will bore up to 90 ft in the high wall horizontally at any given elevation between five and 32 ft above the coal. The platform on which the drill is mounted operates hydraulically. The entire machine is propelled on its caterpillars by a 25-hp, 440-v, 3-phase, 60-cycle a-c motor. Loading holes present no problem as explosives are transported on the platform.

Preparation

This year a marked improvement was seen in the preparation of strip coal. In order to remain in the market, operators were obliged to pay particular attention to producing a clean product. This is a great help to the industry as a whole, because shortly after World War I the stripping industry practically died of starvation due to poorly cleaned product. It took many years to regain consumer confidence.

This year saw the beginning of construction work on the largest commercial cleaning plant ever built. The Hanna Coal Co., builders of this plant, expect it to be the most versatile in the industry. Three distinct types of coal-cleaning equipment are employed for a total hourly output of 1275 tons of clean coal. Washing from 0-7 in. will be standard practice, with the possibility of crushing the +7 in. if necessary to suit the market. Flexibility is the main feature, using many new but proven facilities. This five-track plant will get under way in the first quarter of 1951.

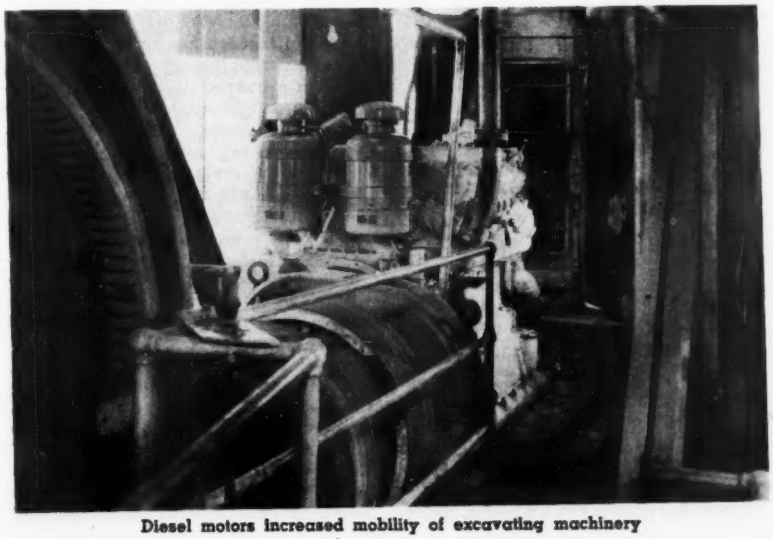
Reclamation

Reclamation progresses right along with the industry. The voluntary reforesting of stripped-over land continues at a fast pace, with many millions of trees being set out each year. In some areas the planting of grasses and raising of livestock have paid big dividends to those who spent valuable time and effort to create a new land for coming generations after the coal has been removed. This, of course, is of vital importance to the support of communities in stripping areas, because of future employment, and a minimum of loss of tax revenue.

With total war again a definite possibility, it is gratifying to know that if called upon, strip mining can carry more than its share of the responsibility of expansion as it did from 1941 through 1945 when its production increased from approximately 10 percent to 20 percent of the total domestic output.

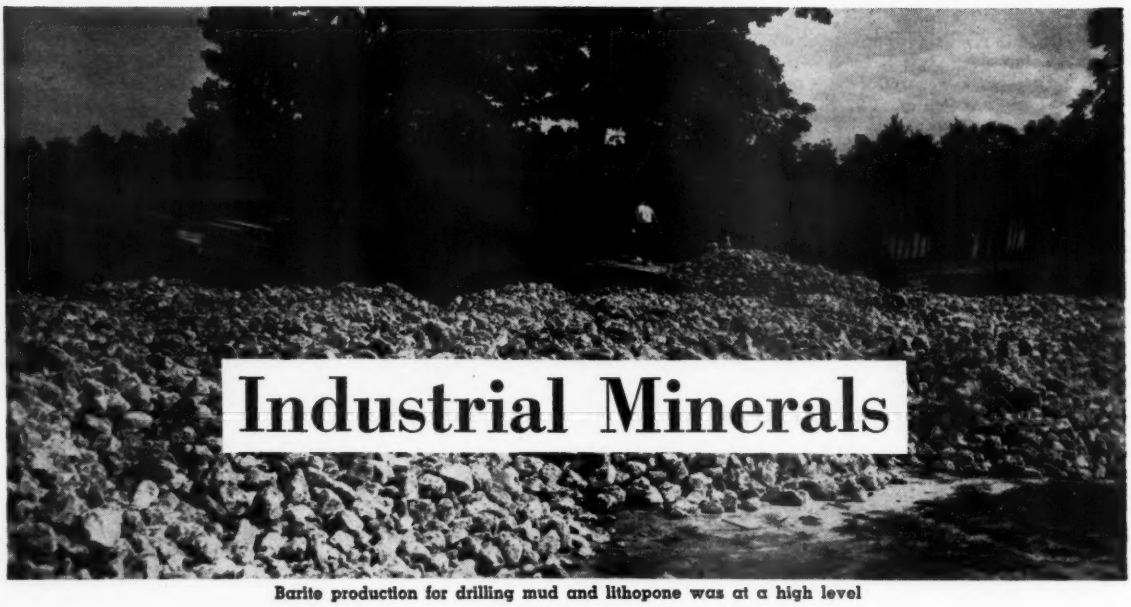
With the Defense Program now rolling, production for 1951 should increase materially over 1950. The possibility of reactivating steam power on the railroads, the shortage of fuel in Europe, and the large expansion of industrial production and electric power manufacture will all figure in stepping up coal production in 1951. When called upon, the strip mining industry will be ready to carry the load.

"Hi-Level" drilling machine ingenious product of Powhatan's Betsy mine shop



Diesel motors increased mobility of excavating machinery

is not a sentiment - it is an economic necessity. —— Charles Sumner



Industrial Minerals

Barite production for drilling mud and lithopone was at a high level

Domestic Production Satisfies Most Requirements as Output Maintains High Levels

By J. L. GILLSON

Geologist, Development Dept.,
E. I. du Pont de Nemours & Co., Inc.

A WIDE range of this country's industrial minerals are produced within its borders, while many are imported in whole or in part. In most categories reserves are ample. Analyzed here is our position with respect to those minerals required in large quantity for effective operation of our industrial economy.

ABRASIVES: Shipments of bonded abrasive implements were within 15 percent in dollar volume of those of the 1943 peak. In 1951 a sharp rise in demand is forecast since the consumption of abrasives closely follows steel production. Crushed and graded bort diamonds are joining fused aluminum oxide and silicon carbide in the composition of grinding wheels. Natural corundum continues in greater demand than imports satisfy. Several new silicon carbide furnaces were installed during the year.

AGGREGATES: With the building boom of 1950, lightweight aggregates of all kinds increased in importance. Interest continues in the development of new equipment and processes and new sources for making expanded aggregates. One such is the clay in the Florida phosphates. Noteworthy is the widespread expansion of plants for "popping" perlite to make it expand. The value of processed perlite sold in 1950 was about $3,000,000, two and a half times that of 1949.

A survey indicated that production of sand, gravel and crushed stone probably reached new peaks. Eastern producers showed an average increase of 14 percent over 1949.

Output of crushed stone is estimated to be 5 percent above the 222,408,140 tons produced in 1949, the biggest increase again occurring in the East, with Pennsylvania leading, followed by Ohio, Illinois, Michigan, New York and California, each with a production of over 10,000,000 tons.

Production of blast furnace slag also set a record of 1950. Output was at least 22,000,000 tons from 66 plants processing air cooled slag and 10 plants making expanded slag.

ASBESTOS: Johns-Manville Co. opened a new quarry near Matheson, Ont. Research on synthesis of asbestos is under way at a number of private and public research laboratories.

BARYTES: Production of barytes was at a high level for the year, principally production for mixing in well-drilling muds. However, since titanium oxide output did not satisfy pigment demand, lithopone plants ran at capacity and used considerable ore, some from Nova Soctia.

BORAX: An important development in this field recently announced is the use of borates in fertilizers, to supply a minor but essential element for proper plant growth. Since too much borax has a toxic effect, borax has been used in increasing amounts for the control of noxious weeds.

CEMENT: Demand for Portland cement and concrete products continued at a high level with shortages in a number of areas. Plants operated at capacity which is about 266,000,000 bbl. New plants were built and capacity was added by the modernization of existing plants. The "dry system" has been favored in new plants. In quarrying, the use of the "drop hammer" increased, to reduce secondary blasting. In plants, longer kilns are preferred, and there has been a wider application of dust collecting systems. Transportation of bulk cement by trucks has increased greatly. An air-activated gravity conveyor placed on the market in 1949 is a radical departure in equipment to handle cement. In June the Portland Cement Association opened a $3,000,000 research laboratory at Skokie, Ill.

Typical of plant expansion during the year was the completion of an expansion program by the Calaveras Cement Co. in California. A third kiln, 360 ft long by 11 ft 3 in. in diameter was put in service as well as four additional silos to hold 60,000 bbl

of finished cement. The use of Lepol system kilns at the Santa Cruz Portland Cement Co.'s plant at Davenport, Calif., has resulted in what appears to be the best fuel economy in the United States. These kilns consume 704,000 Btu per barrel of clinker. In the Lepol system the dry, raw-ground material is nodulized. The nodules are put on a grate where they are partly calcined before being fed to kilns of standard design. The world's longest kilns are at the plant of the Permanente Cement Co. in California which has four wet-process kilns, each 465 ft long.

CLAYS: Western North Carolina reports a production of 23,000 tons of ceramic grade kaolin, which was 20 percent above last year. There has been a notable increase in the use of this grade of kaolin in the manufacture of certain types of glass. North Carolina kaolin comes from the weathered surface of a granite rock called alaskite. About 10-15 percent of the mined material is recovered as kaolin after beneficiation, and 4-5 percent of the mined output is recovered as scrap mica.

DIAMONDS: At the Premier diamond mine in South Africa, a heavy media separation plant was put into operation. This unit has a capacity of 12,800 tons of "blue ground" a day. Demand for diamonds in the United States was reaching 1,000,000 carats per month at the end of 1950.

FELDSPAR, MICA AND PYROPHYLLITE: No outstanding developments occurred in the feldspar industry but all plants were fairly busy. A larger proportion of the ceramic grade feldspar is being produced by froth flotation. Pyrophyllite is being used increasingly in refractories and as a "carrier" for insecticide dusts. Production of pyrophyllite will exceed 110,000 tons. North Carolina is the principal producer.

The supply of muscovite and phlogopite splittings were adequate during 1950. Deliveries of the better quality of block and film were slow and shortages of block, and particularly of film, became quite severe at the end of the year. As in the past, only a small portion of requirements for sheet mica was produced in the U. S. However, this country is the world's largest producer of ground mica, and production during 1950 was at a record high. Encouraging progress was made in the synthesis of mica at the electro-technical laboratory of the U. S. Bureau of Mines at Norris, Tenn., the Bureau of Standards in Washington, and the Colorado School of Mines at Golden, Colo.

FLUORSPAR: Production continued at a high level, but even with imports, hardly equalled the demand of steel, ceramic and acid consumers. Expansion of steel and aluminum production, and demands by the Government for stockpiling are putting heavy pressure on the industry. Prices were raised at the end of the year, a step that should permit some of the western properties to be operated profitably, and hence increase the quantity of spar available. The Ozark Mahoning Co. completed a large warehouse and drying plant at the Marine Terminal in Wilmington, Del., thus providing substantial additional facilities for receiving imported filter cake, the only form in which acid grade concentrates can be shipped in bulk by water.

During the year the St. Lawrence Corp. of Newfoundland also acquired new facilities for warehousing and drying at Wilmington in preparation for an expanded output because of additional capacity at its flotation plant. That company found an important extension of its "Iron Springs" vein, that may extend the life of the mine.

GYPSUM: There was such a tremendous demand for wall board during the year that it became one of the items in shortest supply of all those used by the building industry. Gypsum was also in demand as a retarder, because of the high level of the cement industry. Several new wall board plants were built. The United States Gypsum Co. completed a plant at Gerlach, Nev.; the Schumaker Wallboard Co. opened a new quarry at Henderson, Nev.; Kaiser Industries, Inc., formed a subsidiary called Kaiser Gypsum, and acquired the Standard Gypsum Co. of California, and a wall board plant at Redwood City.

LITHIUM: During 1950 the U. S. consumed over 20,000 tons of domestic and imported lithium ore, plus approximately 1400 tons of lithium concentrates produced as a by-product at Searles Lake, Calif. Lithium greases are used universally in military aircraft and in many industrial greases and are now replacing older type lubricants in the automotive field. About 13,000 tons of lead oxide were replaced by Lithium products in the glass and enamel industries. For the first time much of the lithium ore used was imported from South Africa.

MAGNESITE: After a relatively slow start at the beginning of 1950, the production of dead-burned magnesite increased abruptly during the second quarter, and was maintained at full capacity for the balance of the year. It is expected that the tonnage produced would equal the record of 330,069 tons established in 1948.

More magnesite was imported, largely from Europe, than for the past several years. Many domestic producers imported and enlarged their facilities for producing dead-burned magnesite. One reason for the increase in demand was the expansion in the steel industry. In 1950 the ratio of magnesite per ton of steel produced was 8-9 lb.

MONAZITE: The apparent requirements for rare earths continues to be equivalent to roughly 3000 tons annually. India and Brazil, the principal suppliers in the past, have restricted or forbidden exports, but extensive reserves have been found in river gravels of central Idaho. Hence the United States can probably become self supporting in the needs for this mineral.

Cement industry operated at capacity and new plants were built

REFRACTORIES: The metallurgical industries have been working at capacity during the year and have placed a heavy demand on the refractories industries.

One manufacturer introduced a refractory brick made of a fused mullite base that possesses unusual properties of volume stability in relation to cost. New refractory concretes have been introduced that reduce the cost of lining with brick work. There is a possibility that olivine may become an important refractory material. Some Norwegian olivine has been exported to the United States.

RUTILE: Demand for rutile was brisker in 1950 than in 1949. The sand operations for ilmenite near Jacksonville, Fla., continued to supply important quantities of rutile, but the Virginia rock operations closed.

SALT AND OTHER SODIUM SALTS: Probably the over-all production of common salt was lower in 1950 than 1949, because of a long strike at seven soda-ash plants. For a while production was only 35 percent of capacity. However, chlorine production increased steadily during the year. It remains at a high level, but still cannot meet demands.

Some facilities for making salt were expanded. Morton Salt Co. rebuilt a refinery in Texas, and the Michigan Chemical Co. modernized its installations at St. Louis, Gratiot County, Mich.

Sodium sulphate demand in 1949 had been in a slump caused largely by the fact that a number of the Kraft paper mills installed dust collectors that saved half of the salt cake used. About the middle of 1950, however, the demand started to rise and by the end of the year there was almost a scramble for salt cake. This was occasioned by the completion of a number of new Kraft mills, and by increased demand in the detergent industry.

SILICA: Silica production exceeded that of 1949 by 20 percent because of accelerated demand by steel foundries, in the manufacture of flat glass, building materials, and in the electrical and chemical fields. New uses for silica products included several processes for making fine foundry molds and cores in which phenolic resins are added to fine foundry sands, and there was an expansion in the silicon industry. There were numerous plant extensions and improvements.

STRONTIUM MINERALS: There was no change in requirements and sources of supply. The principal consumers are still E. I. du Pont de Nemours & Co., at Paulsboro, N. J., and the Foote Mineral Co. of Philadelphia. The ore comes principally from England and Mexico, but a study by the California State Mineralogist showed that the low grade deposits near Ludlow, Calif., contain many millions of tons. War demands increase requirements for strontium salts.

STONE INDUSTRIES: Building stone experienced a considerable revival, particularly for finished dimensional stone. U. S. engineers did some jetty repair work in the New Orleans district requiring rectangular dimension stone in blocks weighing up to 20 tons each. Carbide tipped bits for wagon drills and jackhammers gained favor, and improvements in delay shooting by the explosive industry helped also in quarrying, as did the wider use of heavy drop balls, weighing up to 7000 lb, to reduce secondary blasting.

Higher freight rates are stimulating the development of little quarries, requiring smaller quarry and crushing equipment, for semi-portable plants. The use of the wire saw in the granite industry has greatly reduced the waste in some quarries, as well as lowering the amount of hand labor required. There is an increasing shortage of skilled labor in the cutting plants.

Slate quarries continued to operate at capacity, because of the strong demand for roofing slate. Slate flagstones in natural colors are in strong demand, and the adoption of diamond saws to cut rough quarry blocks has assisted in making these attractive blocks available.

Research work is being conducted in Pennsylvania on the manufacture of light weight aggregates from waste slate, which is available in tremendous quantities. Tests have made products weighing only 30-40 lb per cubic foot. In Vermont, research work is directed to make a bonded slate product for structural purposes, using slate granules from 20 to minus 200 mesh, mixed with synthetic resins. The mix is formed in presses of large capacity, and controlled temperatures.

Slate quarries operated at high levels

TALC: The year 1950 was a record one. The increase in the Gouverneur, N. Y., district was 40 percent over 1949, and in California all of the producers are working at capacity. The war situation has caused a large increase in the demand for steatite, most of which is produced in California and Montana. The television industry also is providing a large market for steatite. Hermetically sealed electrical components, such as transformers, capacitators and resistors, require metallized steatite bushings. Ceramic capacitators made of steatite with a dielectric constant of 6000 are available.

TITANIUM ORES: All titanium oxide plants were running at capacity and demand for ilmenite was strong. Shipments from India were not so large as in former years. New York State probably set a record, as did Florida. The new sand operation at Trail Ridge, Fla., of E. I. du Pont de Nemours & Co. finished its first full year of operation. Some unexpected dredging and concentrating problems have held that production back, but by the end of the year the several bottlenecks were being eliminated. It is expected that the 1951 production will be at capacity.

The most important development in the year was the starting of the mine of the Quebec Iron and Titanium Co. at Lac Tio, 30 miles north of Havre St. Pierre, on the north shore of the Gulf of St. Lawrence, and the completion of the railroad to that port. The smelter at Sorel, Quebec, started operations and the tremendous expansion of electrical producing capacity by the Shawinigan Power and Water Co. is well under way. This whole undertaking has been an outstandingly courageous development of mining in a wild area, and smelting with a virgin process.

ZIRCON: The demand for this interesting mineral has expanded slowly, principally in the foundry sand field, in which it has an advantage since molten iron does not wet the zircon sand, and hence does not pick up a layer on the outer surface of the casting. The titanium operation at Trail Ridge has made a large tonnage of zircon sand available.

Anthracite

Warm Weather, Work Stoppages and Car Shortages Take Toll of Production

By C. M. DODSON

President,
Weston Dodson & Co., Inc.

COMMERCIAL production of anthracite in 1950 was not much better than in 1949, totalling 43,200,000 net tons for the year 1950 as compared with 41,540,000 net tons the year before. Three factors seriously affected the 1950 output of the industry: short working time in January and February because of the union-imposed three-day work week; abnormally warm weather—degree days for New York City amounting to 7.9 percent less than normal; and further losses of markets to substitute fuels. Periodic car shortages, particularly following the outbreak of the war in Korea, also adversely affected production at many mines. Shown above are preliminary statistics.

	Calendar Year 1950	Calendar Year 1949
Commercial Tonnage Produced	43,200,000 net tons	41,540,000 net tons
Tonnage Loss due to Weather being Warmer than Normal	3,000,000 net tons	8,000,000 net tons
New York City Degree Days for 12 Months (Normal, 5275)	4860	4240
12-Month Degree Days Below Normal.	7.9%	19.6%
New York City Degree Days from Sept. 1st to Dec. 31st (Normal 1856)	1686	1495
No. of Days Worked by Industry	Est. 215	195
Days Lost Due to Strikes	14	33

Due to producers' limited storage facilities, anthracite is not a commodity that can be prepared and then stored for future sale. Its production is determined mainly by what the market will accept. That's why the shipment of coal in the summer months is so important to assure an adequate supply for winter needs. The movement of anthracite to retailers and consumers during the summer months of 1950 did not come up to expectations, despite the fact that, in face of rising operating costs, anthracite producers offered reduced summer prices as of April 17, 1950—reductions at that time averaging 50¢ a ton on all sizes. These spring reductions were restored in periodic increases starting June 1, 1950.

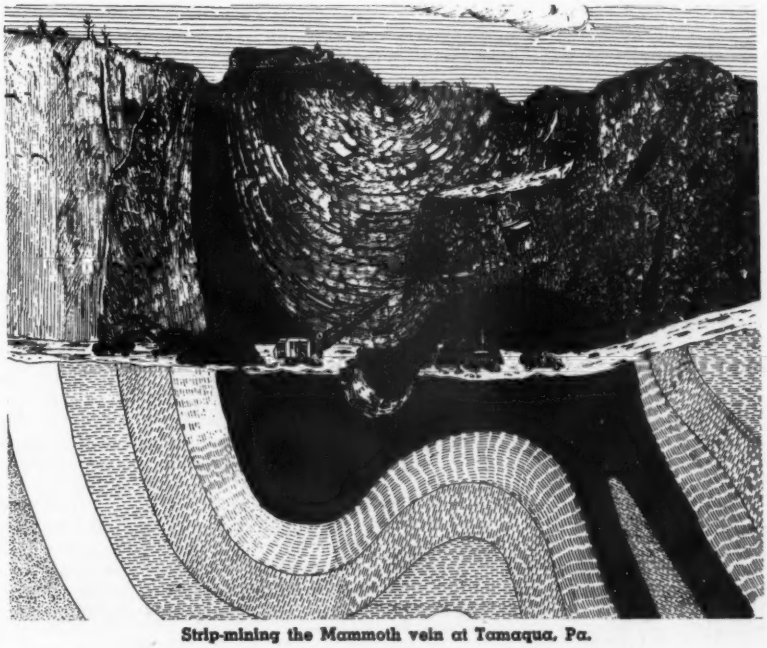
A new anthracite wage contract was agreed to between the operators and the union as of March 16, 1950, following the enforced three-day per week working schedule during December 1949 and January and February 1950. The new contract provided, among other things, for a 70¢ per day wage increase to miners and increased the producers' contribution to the miners' health and welfare fund from 20¢ a ton to 30¢ a ton. There were no labor interruptions in 1950 following adoption of the new agreement, but output per man per day continued to be a disturbing factor in the production picture.

Open Pit Production Up

Stripping coal was again necessary —its lower cost of production helping to offset the higher cost of deep-mined coal where labor is such a potent cost-producing factor. In certain areas of the anthracite market there still seems to be an aversion to anthracite that is offered as strip-mined coal, although of course it is no different in quality from coal from inside the mines and is every bit as good, coming as it does from the same veins mined underground. The percentage of anthracite stripping coal to total anthracite fresh mined has increased materially over the past ten years and compares as follows:

1941	14.3%
1942	16.7
1943	17.4
1944	20.8
1945	22.4
1946	25.2
1947	25.4
1948	26.5
1949	27.7
1950	Est. 28.5

A somewhat unique development in strip mining was begun at Tamaqua, Pa., in the spring of 1950 by the Silver Brook Coal Co. The position of the "Mammoth Vein" and the formation of the overlying strata presented a rather complicated engineering problem. At the stage illustrated in the drawing, the pit was 250 ft deep; eventually, it is estimated, it will be down about 550



Strip-mining the Mammoth vein at Tamaqua, Pa.

ft. Coincident with the strip mining, drift openings are also being developed for underground mining of the Mammoth and Buck Mountain veins.

Campaign Promotes Anthracite

In addition to severe oil competition throughout the year, natural gas pipe lines were extended into the anthracite consuming area, and although it is generally believed that oil will bear the brunt of gas competition, no doubt anthracite too will be affected.

Because of this heavy competition from substitute fuels, anthracite producers felt it advisable to embark on a forceful advertising venture. On July 11, 1950, the industry announced, through the Anthracite Institute, the start of a new million dollar anthracite promotional campaign, almost half of which was earmarked for television advertising. This newest form of taking the story of anthracite directly into the home through eye appeal, as well as special newspaper and magazine coverage, is particularly aimed at educating the public to the realization that anthracite can be as automatic as any other fuel, is economical, safe and healthful.

The advertising program was augmented in August 1950 by the appointment of additional well-trained heating consultants, who were placed throughout the consuming area to further promote the use of anthracite through new contacts and to improve firing experience of present users in order to hold them on anthracite. The results of their efforts in the latter half of 1950 proved outstandingly worth while.

Quite generally throughout the industry, there was evidence of more progressive and modern thinking in meeting present-day problems confronting anthracite. Large and small operators met in unprecedented fashion to discuss ways and means of combating inroads of competitive fuels, realizing, probably more than ever before, that for the good of all mutual cooperation was essential.

Anthracite-carrying railroads finally revised their anthracite tariffs and put them on a "net" ton basis as of July 20, 1950. There were no anthracite freight rate increases during the year, although demurrage rulings for "free time" were changed and demurrage rates increased in order to speed up car handling.

Heating Equipment Developments

Calendar year 1950 was one of the most promising yet experienced by manufacturers of automatic anthracite heating equipment. All equipment producers reported capacity output over the greater part of the year, with a surprising backlog of orders on their books at the close of the year. Newly developed stokers and boiler-burner units were offered the public, and Anthraflo and Anthratube manufacturers advertised warm air installations for the first time.

The outstanding development in the industry from a market viewpoint, which after all determines the health of the producing end, is the need for the anthracite industry to develop a growing outlet for its product. Results reemphasized the industry's utter dependence on the weather as a sales stimulant, and during the past two seasons of abnormally warm temperatures, quite a number of anthracite producing companies were forced out of business, so that the industry production potential as of the end of the year was considerably less than it was in 1948. Lack of orders for full-time production has also retarded development work in those mines that are still producing, and any sudden large boost in demand would find the industry hard put to supply the tonnage.

The national defense program adopted after start of the Korean conflict was bound soon to affect anthracite operations. In order to keep abreast of developments in Washington, the Anthracite Institute reactivated its previous war-time Washington, D. C., office in October. By year-end the industry was already feeling the effects of rising costs and scarcity of materials due to defense planning economy.

Anthracite Prepares For Defense

In anticipation of controls and price fixing, Secretary of Interior Oscar L. Chapman in December 1950 set up the Defense Solid Fuels Administration and appointed Charles W. Connor as administrator. Mr. Connor immediately set about to clear some of the equipment and transportation bottlenecks so that coal production mignt flow more smoothly. As deputy administrator in charge of matters pertaining to production and distribution of anthracite, Mr. Chapman appointed an anthracite man—Edwart T. Klett of Wilkes-Barre, Pa.

One of the Washington developments that may affect future anthracite marketing is the so-called "Myers Resolution," that provides for governmental investigation of all available United States fuel resources and the formulation of a national fuel policy. The resolution was proposed by Senator Francis J. Myers in March. It was reported on favorably by the Senate Interior Committee in August, and a preliminary report on the investigation is now awaited. In advocating some such action, Secretary of the Interior Chapman pointed out that coal (anthracite and bituminous) constitutes approximately 95 percent of all our total fuel resources and that it was imperative for the welfare of the nation, therefore, to preserve the industry.

Zinc

(*Continued from page* 54)

age, may have had up to seven years' experience underground, in mills and in smelters. The whole rearmament, National Emergency, War Mobilization, or whatever this transition program we are in may be called, can be adversely affected by this lack of a considered policy.

It is most unfortunate that as one of the two great, basic industries, mining is not given the same consideration as agriculture, but we still live in an era of "politics first."

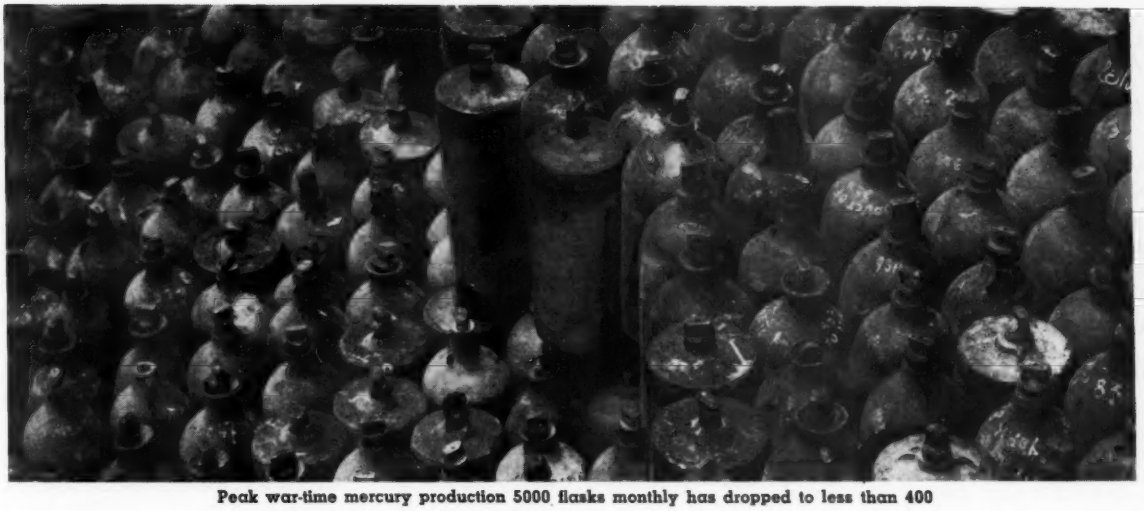
Zinc Deficit in Prospect

And what does this all add up to? Again using American Zinc Institute figures, the first answer is that domestic mines produced approximately 617,000 tons of zinc including recoveries from residues in 1950, and an optimistic forecast for 1951 is 675,000 tons. At late 1950 rates of production, some 850,000 tons of zinc in concentrate will be needed by primary smelters and an additional 130,000 tons in similar form for the manufacture of zinc pigments.

It seems reasonable to assume that required deliveries in 1951 will be at least equal to the 1,145,000 tons of 1950. Counting upon 675,000 tons from domestic mines and assuming imports of 230,000 tons in concentrates and 150,000 tons in metal (the 1950 figures), we are faced with a deficit of 90,000 tons. It is quite conceivable that we will not be able to obtain the above import tonnages with European prices higher than our own. Also it must be kept in mind that U. S. smelters have no large stocks to draw upon as was the case at the beginning of 1950.

New mines cannot be started like new factories. The raw prospect must first be found, developed and equipped, and much of the way along this route entails considerable financial risk. The time involved is a matter of years, not months. While the Certificates of Necessity permitting certain new facilities to be written off over a five-year period was a constructive step, the new tax law plus the excess profits tax certainly tends to further deteriorate the already weakened incentive to search for and develop new sources of metals. It is also no inducement to the miner (lacking a "shooting war") to deplete his higher grade reserve.

Common sense applied to stockpile purchases, the recent and forthcoming restrictions on the uses of zinc, and an assurance of an adequate supply of experienced labor through prompt government action may overcome the large deficit indicated, otherwise the outlook is not a rosy one.



Peak war-time mercury production 5000 flasks monthly has dropped to less than 400

Domestic Supplies of Strategic Minerals

Immediate Effort Required to Expand Output as Emergency Demands Rise

By DAVID D. BAKER
Consulting Engineer
Reno, Nev.

EXTRAORDINARY demands on the domestic mineral industry during World War II emphasized the fact that every mineral or metal used by industry in times of peace becomes strategic during an emergency. To wage successful all-out war, we need an abundant supply of every metal needed in peace-time and in such quantities that industry may continue at peak capacity and also expand to supply military needs.

Prior to World War II the U. S. production of manganese, chromium, quicksilver, antimony, and cobalt was in a state of virtual collapse, and output of other metals was at low ebb. Fortunately, during those years, certain far-sighted individuals in government and in industry, being aware of the predicament we would face in an all-out war, took steps to revive these industries. Edward Stettinius and others of the National Defense Council called on private industry to do its bit toward the revival of these war-essential industries. Now we are confronted with an emergency that may be even more serious than World War II. We should take stock of our position with respect to those vital materials without which a successful all-out war cannot be waged.

MANGANESE—Military secrecy does not permit disclosure of the amount of manganese held in stockpile, but it is safe to say that there is not enough to permit full operation of the steel industry without importing large tonnages from abroad and producing all possible high-grade manganese from meager domestic sources. At the peak of World War II production levels, the highest domestic output of usable manganese in any one year was 250,000 tons. In this same period the steel industry used about 1,680,000 tons of manganese ore each year.

Although the domestic industry cannot be expanded to the point where the out-put of high-grade manganese will take care of yearly needs, we do have large reserves of low-grade material. Given time for the development of these deposits, building of plants for processing the material, and initiating modifications of technique in steel manufacture, we could become self-sufficient in manganese.

Low-grade manganese reserves exist

Domestic chrome ore requires complicated and costly treatment

at Batesville, Ark.; Butte and Phillipsburg, Mont.; Artillery Peak in Ariz.; Aristook County, Me.; and at the Three Kids Property in Nevada. Also a tremendous, but extremely low-grade, reserve exists at Chamberlain, S. D. Other smaller reserves of low-grade manganese are to be found on the Olympian Peninsula in the state of Washington, in the Franciscan formation along the coast of California, and scattered in small deposits along the eastern sea-board and in several western states.

CHROMIUM—Most of the chromium used in the prosecution of World War II was imported from Soviet Russia, Turkey, South Africa, New Caledonia, Cuba, and the Philippines. Strenuous efforts were made to build up the domestic supply, but the total production from 1940 to 1945 amounted to only 297,000 tons of low chromium-iron ratio material. This was a period when more than 850,000 tons were required annually by our alloy, refractory, and chemical industries. Chromium was produced from numerous pod-like deposits in serpentine along the Pacific Coast, from Oregon beach sands, and from the large tabular deposits of low-grade chromite in the Stillwater complex of Montana.

Because of the dismantling of wartime plants, we are little better off today than we were in the years prior to the outbreak of World War II. We can produce some chromium, but most of the production will require complicated and costly metallurgical treatment to make it suitable for present-day practices in steel manufacture, or it can be used at the sacrifice of a great deal of present capacity for the manufacture of chrome alloys.

VANADIUM—Prior to World War II domestic production of vanadium amounted roughly to one half of domestic consumption. Wartime production more than kept pace with greatly accelerated demand, and the present production rate satisfies about three-fourths of the requirements.

Vanadium is produced as a by-product of uranium mining, so some vanadium has been available for stockpiling. A small amount is now produced as a by-product from Idaho phosphate rock. Large reserves exist in the Colorado plateau region and in the phosphate fields of Idaho and Wyoming. Adjacent to the phosphate rock are vanadiferous shales representing a large reserve of low-grade vanadium that can be drawn upon under military necessity or when economic conditions permit.

MOLYBDENUM—Among the alloy metals, molybdenum stands out as one in abundant supply. Large reserves exist at Climax and Urad, Colo., and large production is available as by-product from copper mining at Bingham Canyon, Utah, and other western copper producing areas. Some by-product molybdenum is obtained from tungsten mining. All things considered, it appears likely that domestic production of molybdenum can be built up to supply the greater part of any war-time demand.

TUNGSTEN—Tungsten mining in the United States has been unable to compete with foreign importations except in time of war. The United States has been exceedingly fortunate in that both before World War I and prior to World War II, bonanza deposits were discovered in time to contribute a major portion of war-time needs. The Atolia, Calif., and the Boulder, Colo., districts, in peak production in World War I, are now practically exhausted, and the same is true of the Yellow Pine mine that was discovered by accident and became the major individual contributor to the supply of tungsten during World War II.

In recent years, low prices and unstable demand have forced tungsten mines to suspend or curtail operations. A year ago all of the large tungsten producers were at the point of shutting down and were able to continue only when the stockpiling program was expanded and contracts negotiated at prices that would barely permit operations to continue. Not so fortunate were the many smaller mines that were unable to produce because of their inability to meet the government specifications without a high treatment cost for removal of molybdenum and other impurities.

Only the most optimistic would believe that, faced with another emergency, we could rely on the discovery of a hitherto unknown deposit of tungsten that would enable the domestic industry to meet the large demands that would be made upon it. It appears probable that during a future emergency a great part of our country's requirements could be filled from the many small tungsten mines that could be brought into production if the selling price of this vital material were to be brought into line with present-day production costs.

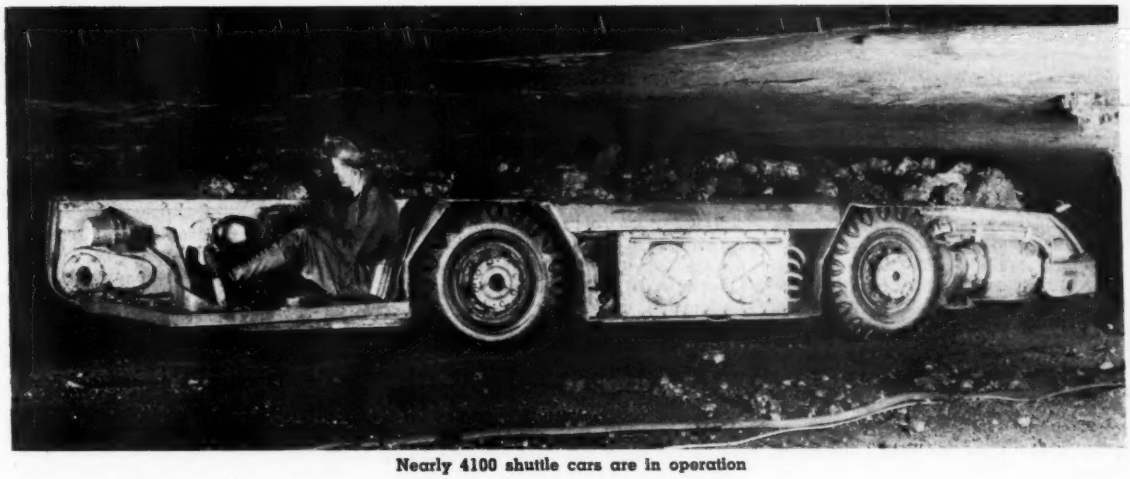
Since the end of World War II we have seen the government-financed Salt Lake tungsten plant sold to private interests and wrecked and the domestic tungsten industry whittled down by low prices, tariff reductions, high operating costs, and rigid specifications to the point where only a few of the major producers were able to survive, and these only because they were able to sell their product to the government stockpile.

We are fortunate in having relatively large reserves of low-grade tungsten deposits. It appears probable that given ample time and proper support, the domestic tungsten industry could supply a large part of our emergency requirements.

Much of emergency tungsten requirements could come from small mines

COBALT—In 1949 the only production of commercial cobalt in the United States was from magnetite ores mined by the Bethlehem Steel Co. at Cornwall, Pa. Some cobalt is recovered in the electrolytic zinc plant operated by the Sullivan Mining Co. at Kellogg, Idaho, and in the latter part of World War II, a nickel-cobalt concentrate was produced by the St. Louis Smelting and Refining Co. at Fredericktown, Mo. The Calera Mining Co., a subsidiary of the Howe Sound Co., is now engaged in extensive development of the copper-cobalt deposits of the Blackbird district in Idaho. With the near exhaustion of the reserves at Cobalt, Ont., the Blackbird district promises to become the major producer of cobalt on

(*Continued on page* 76)



Nearly 4100 shuttle cars are in operation

Advances in Underground Transportation

How Coal Haulage Reached Its Present Status

By P. R. PAULICK
Consulting Mining Engineer,
Library, Pa.

IN the past, the transportation of coal from the face to the outside was comparatively simple, because of small quantities and short distances. Coal was transported upon the backs of men, women and sometimes children. This is still the practice in some countries. Later, sleds were made and eventually planks were put on the mine floor to permit the sled to move more easily. This was the forerunner of present-day track.

Over the years, the motive power was supplied first by human beings, then by dogs, ponies and mules, and finally by mechanical means in the form of steam, compressed air, and lastly, electric power, and all stages exist today.

Manpower

Coal was first mined in the United States near Richmond, Va., about the year 1700. But even small commercial mining did not get under way until about 50 years later. The first recorded reference to coal in any form was made by Theophrastus, a pupil of Aristotle, who in 371 B.C. called it black magic stone because it could be set afire. Our first record in the so-called Christian era was about A.D. 852, when coal lumps, dislodged by the action of the sea on the cliffs and scattered over beaches, were gathered and used for fuel by the cowled monks in Durham, England. Transportation then was, indeed, a major problem because all coal was carried in baskets by human beings.

In 1793 the anthracite fields of Pennsylvania were first opened and developed. Commercial operation of these mines on any extensive scale did not get under way, however, until 1820. The now-famous Pocahontas coal fields of West Virginia were not opened until about 1882.

During these periods it was not possible to haul or handle any volume; entries were small, coal heavy, and roadways were wet and muddy. A large percentage of the workers had to be used for transporting coal. It was tough, difficult and brutal work and in many cases it enslaved the miner's whole family. Father dug and loaded coal with little help while the rest of the family carried it to the outside.

Mechanical Power

Steam power was introduced and haulage mechanization was born. Later on, compressed air was utilized (about 1880) and mechanization was

Modern coal mine locomotives are a far cry from mule haulage

extended to the cutting phase of mining in the form of a "puncher" machine. About 1885 electricity was introduced and the mechanization of the cutting and transportation phases of mining was accelerated.

Modern underground haulage systems are complex. There are in use large mine cars, up to 15 tons capacity; large locomotives, up to 40 tons weight; heavy rail, up to 90-lb; double track; dispatching systems; and belt-conveying systems to transport the coal from the working face to the outside. For the purpose of simplicity and clarity, present-day haulage systems will be divided into three main categories together with the several accompanying sub-divisions.

A. MAIN LINE HAULAGE
   (1) Track, locomotives, mine cars
   (2) Rope, mine cars
   (3) Belt conveyors

B. SECONDARY HAULAGE
   (1) Track, locomotives, mine cars
   (2) Rope, mine cars
   (3) Belt conveyors

C. PRIMARY OR GATHERING HAULAGE
   (1) Track, locomotives, mine cars
   (2) Shuttle cars
   (3) Chain conveyors
   (4) Shaker conveyors
   (5) Belt conveyors

No attempt will be made to discuss the use of mules or men as motive power, although there are a few mines in this country and many in foreign countries that rely on such systems.

Track Haulage

Here, similar items will be discussed together regardless of the main category under which they fall. Item No. 1 under all three categories represents a combination of track, locomotive and mine car haulage. Track was used from the time the miners laid planks on the floor. After the planks came wood rail—pieces of timbers usually 3 by 4 in. laid to gauge when small cars and mules were used to pull the load. Later on steel rails came into general use, first light rail 12-16 lb per yd. Rail-weight gradually increased until today 60-90-lb rail is common. Tracks are well ballasted, bonded and in some cases welded on main haulage lines. One mine uses 110-lb rail on main line haulage, but this is an exception. In general, main line track today consists of 60-90-lb rail laid on wood or composite ties, in many cases treated against rot. Trolley wire ranges from 4—0 to 9—0 with compensating feeder line running parallel to the trolley. Rails are either electrically bonded or welded. For secondary haulage track 40-60-lb rail is usually used. In primary haulage 20-40-lb track is the rule.

History states that the first electric locomotive using power from an independent external source was built in Germany by the Siemens & Halske Co. and was shown in the year 1879. In 1882 an electric locomotive was built by the same company and installed in the royal coal mines at Zankerode, Saxony. Later on, in 1883, the same type locomotives were adopted by the Consolidated Paulus & Hohenzollern collieries at Beuthen. In July 1887 the Lykens Valley Coal Co. installed an electric locomotive at their Short Mountain colliery at Lykens, Pa. This locomotive was built by the Union Electric Co. of Philadelphia. It had one 30-hp motor operating at 400 v. d-c. No trolley wire was used. The positive conductor was a 25-lb rail laid separately and parallel to the haulage track. In 1888 the Jeffrey Manufacturing Co. built the first electric locomotive used in bituminous coal mines, for the Upson Mining Co. at Shawnee, Ohio. Here again no trolley wire was used, nor a separate rail either, but two parallel one-inch pipes were used as conductors.

An outstanding development in large locomotive construction for main line work is the unit built by the Goodman Manufacturing Co. for the Ebensburg Coal Co. This unit consists of two 20-ton locomotives coupled in tandem. The six motors codevelop a total of 720 hp.

In some countries, especially in Europe, compressed air locomotives are used extensively for main line haulage work. During the last few years, however, Diesel locomotives have been replacing compressed air units, mostly because the Diesels are much more economical to operate.

In the United States, both in coal and metal mines, battery locomotives are being used rather extensively, especially for gathering work, or primary haulage. Main line haulage utilizes few units of this type.

Coincident with the improvements in locomotive design and development has been the development of mine cars. Until recently mine cars of one- or two-ton capacity were usual. Cars of five-ton capacity were rare. Today many coal mines use cars of 10 tons capacity, and a few are putting in 12 or 15-ton cars.

Rope and Mine Cars

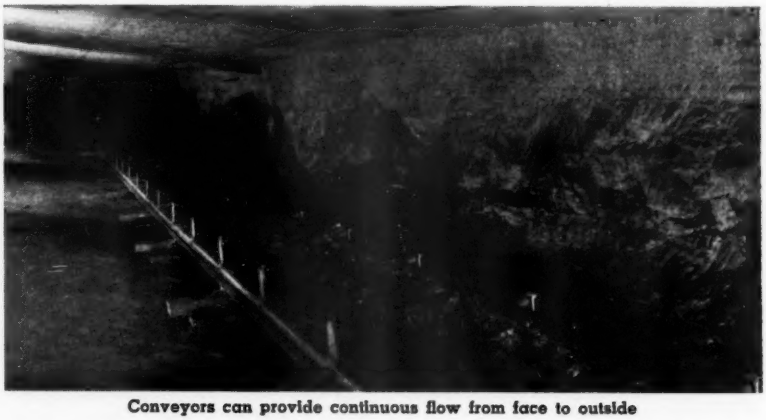
This system is seldom seen or used in the United States, but is popular and prevalent in Nova Scotia, Japan, and many European countries. However, in some European countries, Diesels are rapidly replacing ropes as well as compressed air locomotives. Rope haulage is an inefficient and uneconomical method of transportation. As a rule only small mine cars can be used with rope haulage so that even if power is increased, it is difficult to improve unit capacity.

Belt Conveying

With "loco and track" and "track and rope" haulage systems, even with the assistance of devices such as dispatching systems, double track and automatic loading, the coal flow from face to tipple is intermittent, subject to many stops and delays. Conveyors seem to offer a means to provide continuous flow.

About 1904 the first chain conveyor made in the United States was installed at Vintondale, Pa. The following year a scraper conveyor was put to work. Shaker conveyors were introduced into U. S. coal mines in 1925. Although these units, chain and shaker, were different from belt conveyors and were used strictly as gathering mediums, rather than main line haulage, they were the forerunners of elaborate present-day belt conveying systems.

According to somewhat hazy records, it seems that the first belt conveyor was installed in a Virginia mine about 1929. Another installation was made in western Pennsylvania in 1931. The first completely belt-conveyorized operation was made in 1934 in eastern Kentucky. This was soon followed by one in Ohio in 1935. About that time the belt conveyor idea had taken firm hold and many mines in all the coal-



Conveyors can provide continuous flow from face to outside

producing states put in belt conveyors. Today there are more than 5,700,000 ft or 1000 miles of belt conveyors in use in U. S. coal mines. This is a tremendous length when one considers this system of transporting coal was born in the 1928-1929 period, slightly more than 20 years ago.

There are many advantages to the use of belt conveyors for main line, secondary and primary or gathering haulage. They offer the only system where the flow of coal can be continuous from the working face to the tipple.

Belt conveyors for main line haulage usually average about 42 in. in width. However, there are a few installations where 60-in. belting is used. In secondary haulage belts range from 30-36 in. Gathering belt conveyors usually are 30 in. wide. Formerly 24, 26, and 28-in. belts were used but these are being replaced.

Lengths of belt conveyors vary with local conditions. Present-day main-line belt conveyors average about 1000 ft with a few units 2000 ft in length. Although there are several installations where five-or six-mile conveyors are used, the total length is made up of several units installed and operated in tandem. Single units as a rule do not exceed 3000 ft in length.

The ultimate length of a main line belt conveyor in a single unit is dependent upon the tensile strength of the rubber belt itself. To overcome this handicap, one belt manufacturing company several years ago developed the idea of inserting steel cables in the body of the carcass instead of the usual cotton or rayon cords. According to data furnished by this company they can now build a belt conveyor in one unit up to five miles in length, with sufficient strength to lift the load a total height of 1500 ft.

Here are a few of the many operational advantages inherent in belt-conveying coal underground:

(1) Simple roadbed, no preparation, no wires
(2) Narrow entries, timbering simplified
(3) Dust hazard low
(4) Not likely to be soon superseded
(5) Life expectancy high
(6) Light weight for a given capacity
(7) Easily enclosed, all-weather operation on surface
(8) Quiet operation, low degradation of material
(9) Mobility, easily dismantled and moved
(10) Low power consumption, low labor, upkeep
(11) Accident hazard low
(12) Easy push button operation and control
(13) Adaptable to any terrain, undulating or level
(14) Can be used in grades up to 30 percent
(15) High capacity per hour, limited only by the speed and width of the belt.

Shuttle Cars

As the productivity of the individual mine increased, so the problem of taking coal away from the production face increased. This problem became more acute after mechanical loading of coal was developed in the early 1920's.

Up to 1932, primary or gathering haulage consisted of mine cars and track, especially behind mechanical loaders. As loading machines increased in size and capacity, mine cars also increased. But even when mine cars attained a capacity of ten tons there was a demand for better means of taking the coal away from the loader. During 1932 a new idea was born —eliminate track and cars in a section and substitute a rubber-tired shuttle car—"trackless" equipment. One of the first such units was installed and worked in a southern Indiana mine during 1933 using a tractor-trailer shuttle car with a drop bottom instead of the present-day chain conveyor unloading arrangement.

Trackless mining maintained a slow but steady growth from 1933 to 1938 when the Joy Manufacturing Co. developed and built the first battery-powered shuttle car equipped with a chain conveyor for unloading purposes. In 1939 the first cable-reel shuttle was built. By 1941, several types and sizes of shuttle cars, both battery operated and cable-reel types, were in operation. In 1944, four-wheel steering and four-wheel drives were inaugurated and the shuttle car and "trackless" mining system grew rapidly. Today the ratio of sales is 10 percent battery types and 90 percent cable-reel types.

There are nearly 4100 shuttle cars in operation in the continental United States. They range in size from a small 2½-ton capacity to the monster 12-ton capacity jobs.

In June 1949 the latest innovation in shuttle cars was introduced in a mid-western limestone mine—the Diesel-electric driven shuttle car. Incidentally, the feature of this car is, of course, the self-contained power plant, and the development of a "gas scrubber" to eliminate objectionable gases from the Diesel engine.

Chain Conveyors

As a medium of primary or gathering haulage, the chain conveyor is the second largest and oldest type in use today. Since their introduction in 1904 chain conveyors have enjoyed a continuous, successful growth and today there are more than 4500 units in operation in the United States.

Chain conveyors are used in many forms and many types of work. There are the small portable 10-12-ft units used in making breakthroughs and face conveyors extending up to 50 ft. Other units are used as room conveyors conveying the coal from the production face to mine care or some other secondary haulage equipment. A few are even being used as secondary haulage units taking coal from one or more room conveyors—shaker or chain—conveying it into mine cars or onto belts. The latest type is now being used in a Canadian mine on a longwall face gathering coal from a continuous miner. This unit is made from aluminum and is more than 500 ft long.

Shaking Conveyors

Shaking or reciprocating conveyors for coal transportation were first developed in Germany sometime in the 1920's. In 1925 and 1926 the first group of such shaker conveyors were imported into the United States and installed in the bituminous coal mines of western Pennsylvania. In 1930 the Goodman Manufacturing Co. acquired all rights to manufacture this type of conveyor including the now-famous "Duckbill" which is a loading head or attachment to the shaker conveyor to make it self-loading. In the following year the Joy Manufacturing Co. started building a different type of shaker conveyor. This used a large spring to provide the "kick" needed to move coal along the conveyor. From 1930 to date the number of these units has increased rapidly until today there are approximately 2000 units in use in the bituminous coal mines of the United States.

There are several types and sizes of shaker conveyors in use from 30 to 90 tph capacity. The size of stroke and strokes per minute vary in the different sizes, but average is an 8-9-in. stroke 75 times per minute. There are some units specially built to convey coal up 5-6 percent grades. But on the whole, shaker conveyors work best on level or near level grades.

The over-all length these units can be extended is usually 300-350 ft. However, in experimental work several have been extended and worked up to 650 ft.

Shaker conveyors can be and are being equipped with 90-deg angle devices permitting the conveying of coal at right angles to the main flow of the coal stream.

As a rule, shaker conveyors are used primarily for gathering haulage work, but in some cases in small mines they are being used both as primary and main haulage units conveying the coal from the working face to the outside. In several installations, the shaker conveyor equipped with a "Duckbill" acts both as loading machine and then as haulage system to convey the coal to the outside.

Potash

New Production Planned as Present Operations Modernize

Producers continued efforts to attain maximum production

By G. F. COOPE
President,
Potash Co. of America

DELIVERIES of potash in North America were approximately 1,400,000 tons K_2O during the calendar year 1950. This is almost a three-fold increase during the last 10 years. In 1940 deliveries amounted to 482,000 tons K_2O. During this same period deliveries by American producers have increased from approximately 382,000 tons K_2O to 1,235,000 tons, or somewhat more than three times. The potash supplied by the domestic producers and imports from 1938 to 1950 are shown on the accompanying chart. Domestic deliveries in both 1949 and 1950 would have been even greater except for a strike in the important Carlsbad producing area which reduced operations from November 19 to February 1.

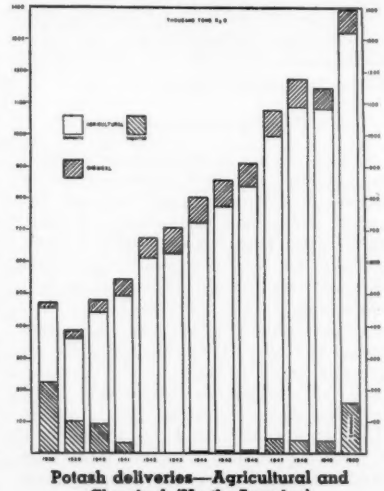
Imports in 1950 amounted to more than 160,000 tons K_2O, according to preliminary data. These came from France, Germany and Spain. They are the highest imports since 1938 and were unusually high in the spring due to orders placed by buyers during the strike period.

Production and Distribution

The primary producers of potash salts market five grades for agricultural purposes and two grades for the chemical industry. The agricultural grades represent by far the greatest portion of production, 94 percent, and the chemical grade about 6 percent. This proportion does not vary greatly from year to year.

Agricultural grades include 60 percent muriate of potash, which is about 95 percent pure potassium chloride; 50 percent muriate of potash, which is about 79 percent pure potassium chloride; manure salts analyzing 20-25 percent K_2O; sulphate of potash which usually runs around 50 percent K_2O; and sulphate of potash-magnesia analyzing about 22 percent K_2O and 18.5 percent MgO. At the present time no one company is producing all these grades. The 60 percent muriate is the dominant agricultural grade, in 1950 comprising about 86 percent of the total. Of the remainder of the agricultural deliveries, the 50 percent muriate of potash made up 6 percent, manure salts less than 1 percent, and the two sulphate forms about 7 percent.

The pattern of distribution among the agricultural grades has changed over the years. In 1940 about 71 percent of the potash was in the form of 60 percent muriate, while in 1950 about 86 percent of the potash was delivered in this grade. During the same 10-year period, the 50 percent muriate of potash decreased from 18 percent to 6 percent of the total, manure salts decreased from nearly 3 percent to less than 1 percent, and the two sulphate forms remained the same, about 7.5 percent of the total. The trend is markedly toward the use of the more concentrated form of potash due to the pressures of high freight rates and demands for more concentrated fertilizers.



Potash deliveries—Agricultural and Chemical (North America)

Agricultural use of potash has parallelled the increase in production over the last 10 years. This growth has occurred in all sections of the country but has been most spectacular in the Midwest as shown on the map. In this section potash consumption has increased nearly five times the 1940 rate while over the country as a whole the increase has been about 2½ times.

The big increase in potash consumption has been due to a combination of circumstances. In the Midwest gradual soil depletion due to removal of nutrients by plants and erosion without sufficient replacement was reducing yield and quality of crops to an extent that could no longer be ignored by farmers. At the same time, demand for high production and good prices gave the farmers money with which to buy the increased amounts of fertilizers the agricultural advisory agencies had been telling them they should use. The great emphasis given to pasture fertilization all over the country created a new demand for fertilizers. In the South, in addition to pastures, the corn-improvement program has resulted in greatly increased use of fertilizer. On all crops in general, farmers are tending to use more fertilizers. The combination of all these forces has resulted in increased potash usage and the trend still seems upward.

During the last 10-year period, the demand for the chemical grades of potash has a little more than doubled. Both muriate and sulphate forms are produced in chemical grades. The

muriate is by far the most important, comprising almost 95 percent of the total. The sulphate makes up the rest.

This covers briefly the over-all picture of the domestic potash industry. It might be added that labor agreements, signed by the principal producers, should give reasonable assurance of freedom from serious interruptions in 1951.

Expansion and Construction

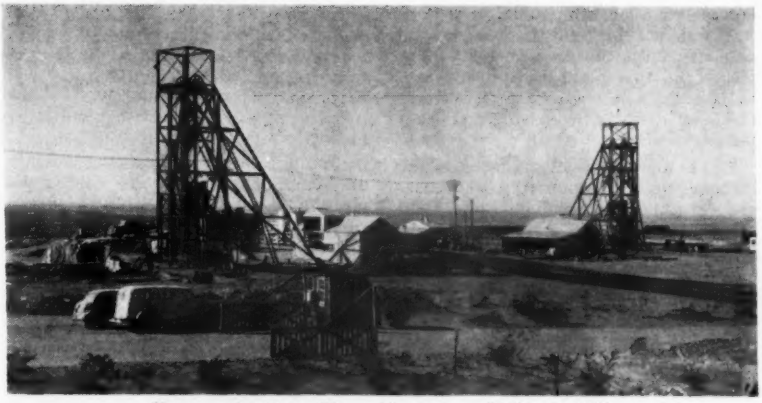
So far as the individual producers are concerned, all report work on plant changes or extensions, as well as continuing efforts through the year to attain maximum production in order to satisfy the strong demands of the national market.

From Bonneville, Ltd., in Utah, Lockwood W. Ferris, general manager, reports extensive improvement in physical plant resulting in better working conditions and somewhat reduced operating costs. Research is continuous in the hope of lowering production expense, but no radical change in procedure has taken place, nor is any anticipated in the immediate future.

Peter Colefax, president, American Potash & Chemical Corp., with operations at Trona, Searles Lake, Calif., reports a completely new installation for the production of granular potash. This new equipment not only increases the tonnage available but also provides a somewhat larger granulation.

In the Carlsbad area, a newcomer to the field, Southwest Potash Corp., a subsidiary of American Metal Co., Ltd., has announced its intention to sink shafts and build a plant on a recently developed orebody, and preliminary work has already started. They estimate a total expenditure, before production, of $10,000,000. Operation is expected to start late in 1952.

Another new arrival in the basin, Duval Sulphur and Potash Co., is further along. A power line, a road and a railroad spur have been built to the plant site. According to George F. Zoffman, president, two shafts being sunk by Utah Construction Co. were to be down about 580 ft by January 1, 1951. The Stearns-Roger Mfg. Co. started construction of a plant on July 3, 1950, and progress up to schedule was made on this work. Water wells have been drilled and a pipe line contracted. It is estimated that plant production will commence during the fourth quarter of 1951.



New construction will provide new production in 1951

The United States Potash Co., the Carlsbad pioneer, reports through Henry H. Bruhn, resident manager, as follows:

"Mine

"A 90-ft steel headframe was installed at the No. 2 shaft and work was under way to put this shaft in shape for auxiliary hoisting and servicing of the mine.

"A new powder storage magazine of unusual design was built.

"Additional rectifier, shuttle car, locomotive and elevator equipment were purchased and installed underground.

"Experiments were carried on with hydraulically operated boom mounted drills operating from a rubber-tired carriage.

"A Diesel bulldozer was purchased and put into service underground on an experimental basis.

"Granular Plant

"Changes were made in the granular plant circuit in order to increase production and to put out a coarse grained product for direct use by the farmer as a top and side dressing.

"Refinery

"Considerable additional refining capacity was added to the company's plant near Loving, N. M. A new ore bin and complete continuous flow dissolving unit were installed, as well as additional crystallizer and filter equipment.

"One new Babcock & Wilcox boiler was added to the power plant.

"A new bagging and loading plant was built. Additional Santa Fe track spur equipment and a new track loading scale were also installed.

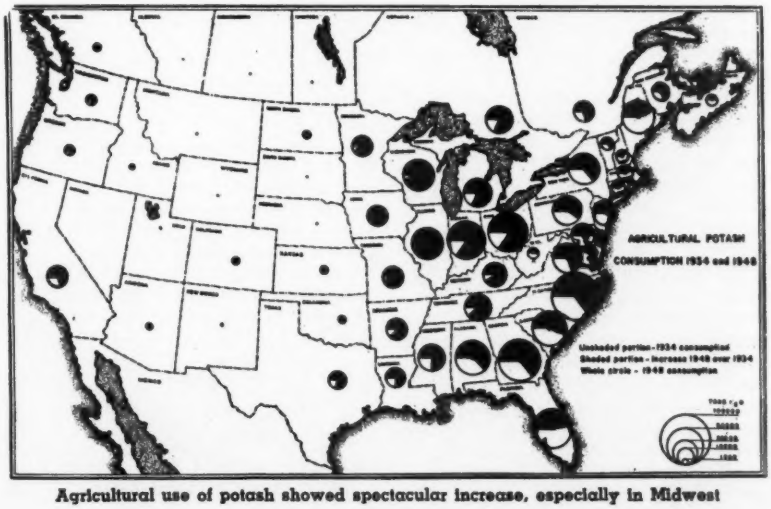
"The daily output of product was increased during the year, although the plant suffered a loss of production during the month of January due to a strike by the Mine, Mill & Smelter Workers Union, which represents a minority of the employes of the company."

An interesting feature of this summary is the placing of a Diesel bulldozer underground, the first use of equipment of this kind in the district.

From International Minerals and Chemical Corp., Norman Into, vice-president, informs us as follows:

"International started construction on its No. 3 shaft in the month of May and it is expected that this shaft will be completed in the spring of 1951. The plan is to commence work on a No. 4 shaft. These two shafts are being sunk in order to develop the new sources of ore in our southwest ore extension.

"The year 1950 marks the first full year of operation of the chemical plant producing a highly refined grade of potassium chloride. This plant was



Agricultural use of potash showed spectacular increase, especially in Midwest

completed about the middle of 1949, but was not brought to 100 percent capacity until the first of 1950. The output of this plant is a product of high quality, especially designed for use in electrolytic processing and other industrial uses.

"As is undoubtedly the case with the three companies operating in Carlsbad, continued emphasis has been placed by research on the improvement in general processing and mining methods in order to improve the efficiency and the recoveries of the mine.

"An extensive drilling program has been carried on throughout the year in order to delineate our rather large southwest ore extension, particularly along its western boundaries, and which has added materially to the ore reserves of the mine. Further drilling in other sections of the Carlsbad Potash Basin is being done to further amplify, if possible, the present ore reserve situation."

Parker S. Dunn, resident manager of Potash Co. of America, says:

"During the year, Potash Co. of America began construction of a plant located near Dumas, Tex., to manufacture potassium sulphate and hydrochloric acid by the Hargreaves process. This plant, which will cost about $900,000, will begin operations in January and will convert muriate of potash produced at the company's plant near Carlsbad, N. M., into the sulphate of potash which is preferred for certain agricultural uses. The hydrochloric acid will be marketed in the Texas and Oklahoma Panhandle area for acidizing oil and gas wells. Conversion of muriate to sulphate has been carried on for the company by acid manufacturers in other areas, so this represents the first actual manufacture of the products by Potash Co. of America.

"Plans were completed during the year and the contract was let to Winston Bros., Minneapolis, Minn., for the sinking of another ventilation shaft to be known as the south shaft. Because of the generally poor ground and water conditions in the area, it was decided to freeze the ground to a depth of 350 ft and sink within the ice wall. While this practice is common in Europe, we believe this is the first time it has been used in this country in the Southwest. Twenty-eight vertical holes have been drilled on 3½-ft centers around a 26-ft diam circle. The holes have been cased and refrigerated calcium chloride brine is being circulated to the bottom of them. It is believed that within 60-90 days of beginning of freezing the ice wall will be closed and sinking can begin. The shaft is to be 15 ft in diameter and the upper section above the salt will be concreted. Total depth is 800 ft.

"Authorized during the year were additions to surface facilities estimated to cost $1,500,000. The principal items are a new 3200-hp Diesel engine for power generation and additional flotation cells. The purpose of these new facilities is largely to improve the quality of our products and the efficiency of production. This work as well as that at Dumas is being done by Stearns-Roger Mfg. Co., and it is estimated that all facilities will be completed by October 1, 1951."

Strategic Minerals

(*Continued from page* 70)

this continent. Present plans of the Calera Mining Co. include the construction of a cobalt refinery in the Salt Lake area.

NICKEL—Like cobalt, an insignificant production of nickel has been obtained as by-product from domestic mines. There are no known reserves in the United States, available for use in an emergency, although a relatively large deposit of low-grade nickel exists in the state of Washington. The Sudbury district in Canada, however, contains the largest known reserves of nickel in the world. The Nicaro property in Cuba, shut down in 1947, is being reactivated.

ANTIMONY—The United States has always depended on foreign sources for about 80 percent of its antimony requirements. There are no antimony mines in this country that can compete with foreign importations in normal times.

Antimony produced domestically is almost entirely a by-product of mines that are able to place a large share of the cost of production on other materials. By far the largest reserve of domestic antimony is found in the Yellow Pine property of the Bradley Mining Co. In recent years, in the face of rising costs and a declining market, this far-seeing organization has gone ahead with the construction of an antimony smelter. As a result of this investment, the United States antimony production from Idaho can be relied on for a sizable portion of emergency war-time requirements. Nevertheless, with China, normally the largest producer of antimony, under the domination of Soviet Russia, and with political unrest in Bolivia contributing to the uncertainty of supplies from South America, our situation with respect to this much-needed metal is far from secure. If a time should come when we were chiefly dependent on domestic antimony, we would have need of every pound that could be produced.

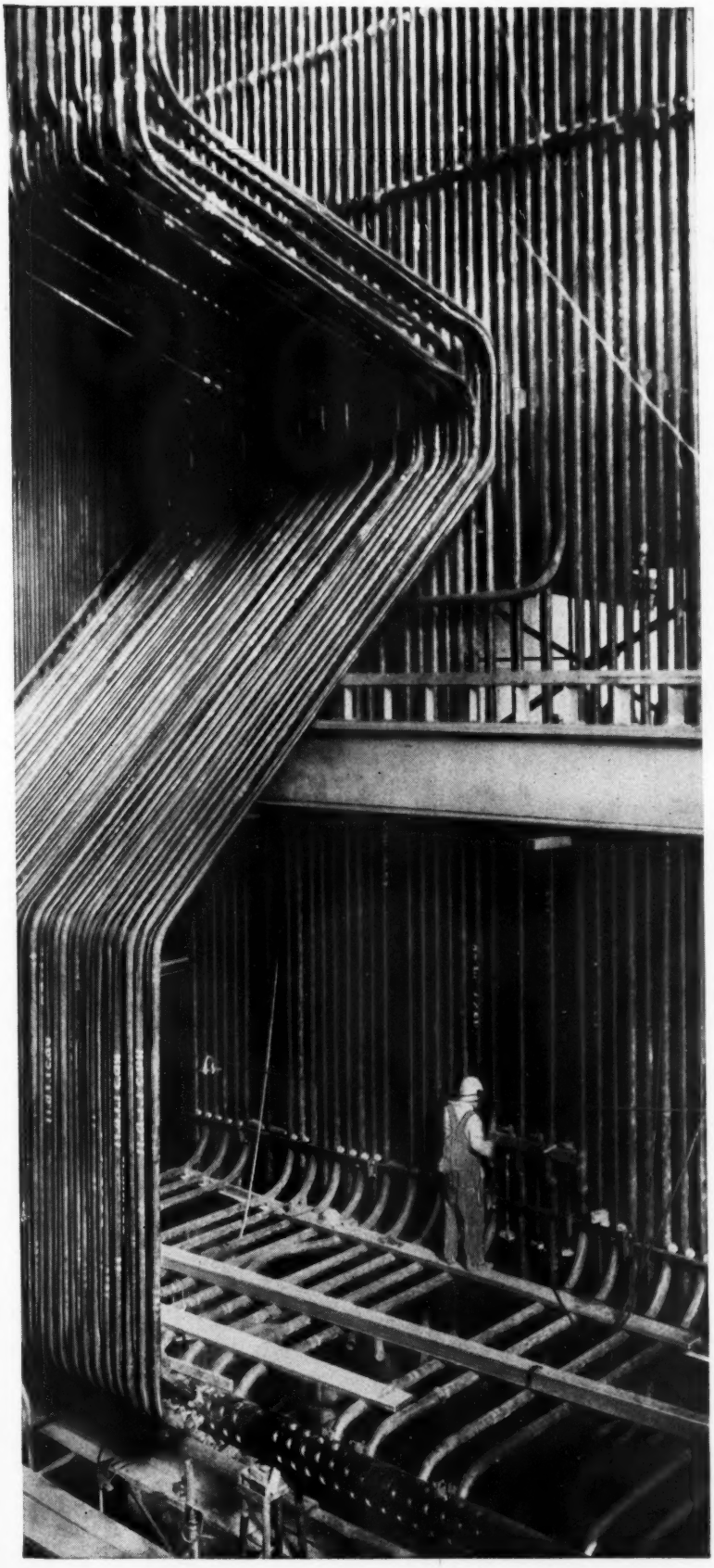
MERCURY—Quicksilver mining is at the lowest ebb in many years. From a peak war production of 5000 flasks a month, domestic production has decreased to less than 400 flasks per month. Most of the larger producing companies are shut down, some having even abandoned their properties, allowing the mines to flood and cave. The one large producer still operating is the Sonoma Quicksilver Mines, Inc., in California. The Hermes mine in Idaho is down and said to be in bad working condition; the Cordero in Nevada shut down last February; and the Bonanza property in Oregon, one of the other major World War II producers, has pulled the bottom of its shaft pillar and may never be reopened.

The New Idria mine in California until recently was carrying on some development work. It is likely that this property and the Cordero could be put back into production, but it is not to be expected that domestic producers will be able to compete with low-cost foreign production. To survive at all, the domestic industry must be given some form of production support. What can be done at this late date is hard to say, but it has been estimated that three years' time and a price of $300.00 per flask would be required to bring the domestic output back to the peak war-time production of 5000 flasks per month.

TITANIUM—The past several years, largely as a result of the development of the Sanford Lake titaniferous magnetite deposit by the National Lead Co., have seen a great improvement in the domestic supply. Further improvement is expected from the program being carried on by Kennecott and New Jersey Zinc at the Allard Lake property in Quebec.

Domestic sources of tin, strategic mica, quartz crystal, asbestos, and certain other minor minerals are either practically nonexistent, or the past mining has been conducted on such a hand-to-mouth basis that we are virtually dependent on importation to supply our requirements of these materials.

This brief review of the domestic supply of strategic metals points up the fact that while we are not a "have-not" nation with respect to most of the minerals needed to sustain our peace-time economy, we lack a great deal of being able to claim self-sufficiency in many of the minerals that are most vital during a desperate military emergency.



this "pipe organ" plays a POWERFUL tune for you!

This picture shows the "works" of a modern boiler attached to a huge power generator that turns out electricity from coal to the tune of 150,000 kilowatts—enough to operate 800,000 washing machines simultaneously!

In these 12 miles of pipe, rising 10 stories above the ground, water is turned into superheated steam by burning coal. The steam runs turbine-driven generators which produce electricity for home, farm and factory.

More than half of America's electricity is generated from coal. This past year more than *90 million tons* of coal went into making that electricity. That adds up to nearly one-fifth of the entire mine output of bituminous coal in 1950.

America is fortunate in having all the coal it *needs* to make all the electricity it *wants*. It is doubly fortunate in having an industry that can produce that coal in volume—efficiently and economically.

The American coal industry is made up of thousands of independent mine operators. In recent years, these progressive operators have invested hundreds of millions of dollars in new mine properties and mechanized equipment, in coal preparation plants and research—to bring all coal customers an increasingly *better* product for more *economical* utilization.

Today, no industry in America is better prepared than coal to meet the ever-increasing demands of both civilian and national defense production.

Granted a continuing supply of necessary equipment, transportation and trained man power, America's independently owned and operated coal mines will produce all the coal that's needed to continue to power the nation's progress, in peace or war.

BITUMINOUS COAL
BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

See for yourself at a nearby operating plant

HOW HEAVY-MEDIA SEPARATION PRODUCES A GREATER TONNAGE OF EXACT-SPECIFICATION COAL at any gravity from 1.25 to 2.50

Unlike the pioneer user, you don't have to buy Heavy-Media Separation on faith or theory today. You can visit operating plants, talk to responsible preparation engineers, check costs and results. You can see how Heavy-Media Separation's unique and exclusive four-stage medium control recovers a greater tonnage of cleaner coal . . . how it minimizes medium consumption. You can determine in advance just what Heavy-Media Separation will do on your coal . . . how closely Heavy-Media Separation will duplicate on a commercial scale the perfect separations obtained in heavy-liquid laboratory tests.

Today, 108 Heavy-Media Separation plants are operating or being built in 20 states, 5 Canadian provinces and 17 foreign countries. *Yearly capacity is approaching 50,000,000 tons, half of which is coal preparation!*

Before you decide on any mechanical or gravity separation method for a new cleaning plant or to supplement your present preparation facilities, it will pay you to inspect an operating Heavy-Media Separation plant . . . to make a comparative study of the better overall grade and recovery this unique and efficient coal cleaning process produces.

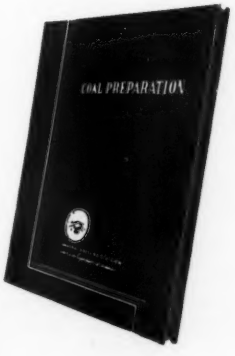
As Technical and Sales Representative for Heavy-Media Separation Processes, we will be pleased to assist in arranging your visits to plants near you. We can also run carload tests on your coal in the Heavy-Media Semi-Commercial Plant of the Cyanamid Mineral Dressing Laboratory at Stamford, Conn. Although we do not design or build plants, we can put you in touch with experienced engineering-construction firms who do, including builders of pre-fabricated plants with capacities up to 400 tons per hour. We will work closely with your engineers in the design and initial operation of your Heavy-Media Separation Unit.

Net, we stand ready to help you in every way to achieve higher quality and higher recovery at low cost through the proper application of a Heavy-Media Unit in your cleaning plant.

HAVE YOU RECEIVED MINERAL DRESSING NOTES #18 "COAL PREPARATION"

This 36-page book, just issued, contains a wealth of new data on Heavy-Media Separation. Clearly and concisely, it explains the fundamental principles exclusive to this separation method. With photomicrographs of medium samples from an operating plant, it shows how Heavy-Media Separation employs unique and exclusive applications of magnetomotive force to provide constant control, conditioning and recovery of the medium. It describes typical operating plants, contains test data, diagramatic flow schemes and much other useful information never before published on Heavy-Media Separation Processes.

If you have not received Mineral Dressing Notes #18 "Coal Preparation," we will be pleased to send you a copy. The coupon is for your convenience.



Mineral Dressing Division,
AMERICAN CYANAMID COMPANY
30 Rockefeller Plaza, New York 20, N. Y.

Kindly send me Mineral Dressing Notes #18 "Coal Preparation"

*Name*_____

*Company*_____

*Address*_____

_____

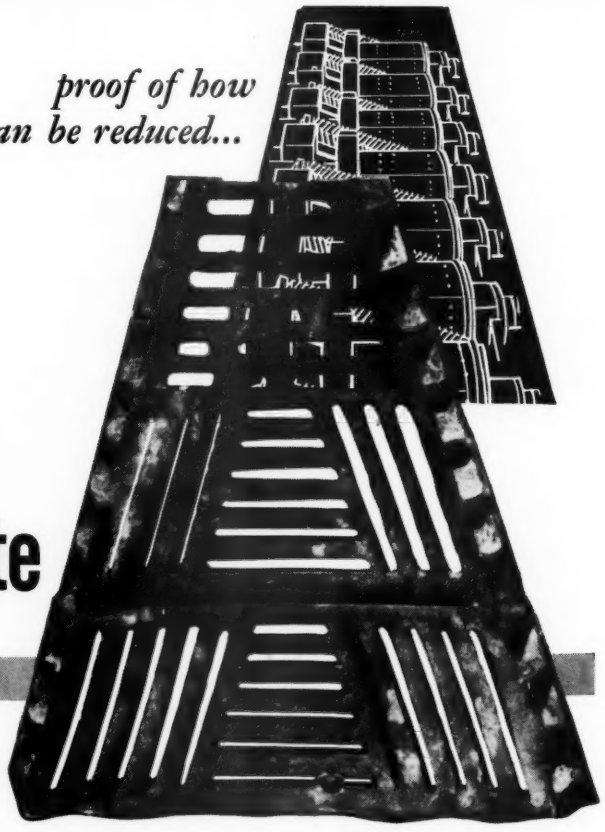
J

AMERICAN *Cyanamid* COMPANY

MINERAL DRESSING DIVISION

30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK

proof of how milling costs can be reduced...



this AMSCO® Grate has milled 193,797 tons

An actual example of how AMSCO Grates last longer, reduce shutdowns and increase milling profits.

Equally Big Savings On Liners, Too!
Recent production figures on Amsco double-wave Liners in a mill grinding copper ore: 667,308 tons ground . . . at a liner cost of about a half-cent per ton! *It will pay you to investigate the long, low-cost service of Amsco Liners!*

Find out more about Amsco Liners and Grates

Be sure to ask for a copy of Bulletin 449-ML. Describes the characteristics of Amsco ball mill alloys; gives additional facts on dollar-saving installations. Free copy on request.

Here's an actual photograph that proves an important, profit-building point to users of ball mill equipment . . . *the real cost of liners and grates is the actual service cost.*

This Amsco grate has milled 193,797 tons . . . compared with just 113,000 tons for a previously used hardened steel grate which ran under identical conditions. And, during this period of 72% greater tonnage milled, *the Amsco grate required no down-time for repair.* The previously used grate started to crack at 50,000 tons—required many shutdowns for plugging holes.

Because of heavy impact, this particular Amsco Grate was made of austenitic chromium-manganese steel—one of three Amsco alloys developed for specific conditions of impact and/or abrasion. These Amsco liner and grate alloys can result in big savings on milling costs. Amsco Engineers are fully qualified to make alloy recommendations based on your operating conditions—*write today for the name of the Amsco engineer nearest you.*

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
422 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Bituminous Coal

Upward Trend in Consumption Matched by Increased Production

By G. A. LAMB
Manager of Business Surveys

and

J. L. ZIERCHER
Business Analyst
Pittsburgh Consolidation Coal Co.

DECLARATION of a national emergency found coal in good supply, as it was when America entered World War II. Bituminous coal production starting with March 1950, when the wage negotiations were completed, through December, was at an annual rate of 550,000,000 tons. This permitted additions to consumer stocks which developed steadily with the general buying surge following the start of the Korean War.

Thus, although most mining operations were suspended during the first two months of the year, preliminary data show that 1950 bituminous production will approach 510,000,000 tons.

Defense activities had not developed to the point in 1950 where extraordinary requirements were placed upon coal. Nevertheless, the bituminous industry began conditioning itself for emergency situations likely to arise. Another world conflict might push the demand well above 620,000,000 tons of the 1943 peak, and substantially higher than '50 production. Aside from requirements of an all-out war, business expansion generated by prospective defense activity will make for increasing demands on coal.

Immediate problems confronting coal following establishment of the defense program dealt with machinery and various mining items, and transportation. Steel, copper and other materials were in tight supply, and it was essential that coal be given a reasonable share of them for machinery and other facilities. Efficiencies developed by mechanization would be lost quickly through equipment shortages. Similarly, it was clear that transportation had to be improved if tonnage were to be moved in full volume to consumers. Manpower had not become a problem but its importance was not overlooked in considering emergency production.

Stated briefly, the bituminous industry with its manpower and plant maintained and given adequate transportation, can produce the tonnage needed. Expansions in production may be necessary for particular kinds of coal, such as by-product grades, which sometimes can be attained through further mechanization of existing plant. On the other hand, if manpower, mine facilities and transportation are ignored at the outset of the emergency, productive capacity will decline and output will be inadequate when required later.

In order that the Government would have cooperation and expert assistance from industry, the Coal Defense Committee was organized early in the fall. This Committee has a wide representation from the bituminous industry as well as members from the manufacturers of mining equipment and the American Mining Congress.

1950 and 1949 Market Volumes Similar

Requirements for bituminous in 1950, i. e., U. S. consumption plus exports, are estimated at 483,000,000 tons, slightly above that of 1949. They decreased for the railroads and exports but increased for the remaining market categories, and in substantial amounts in certain cases towards the end of the year. During the first half of 1950, requirements were running at an annual rate of 440,000,000 as compared to a rate of over 500,000,000 tons during the last six months.

A number of factors contributed to the shrinkage in the bituminous market during 1949 and early 1950. General industrial activity dropped, the winter months were relatively warm, foreign oil made inroads in the east, natural gas expansion was rapid, the dieselization program of the railroads was in full progress, and mining suspensions were disturbing. However, business growth after the start of the Korean War plus mining operations on an increased scale gave bituminous a chance to recover and the possibility of a promising market in the year ahead.

According to advance figures of the Federal Reserve Board's index (1935-39-100), industrial activity in 1950 ap-

World's longest coal train, over 200 cars, reaches Toledo with part of 506,000,000-ton year's production

BITUMINOUS COAL CONSUMPTION AND EXPORTS MILLION NET TONS

	1949[1]	1950[2]
Railroads (all classes)	71.5	62.0
Coke and steel	98.7	111.0
Electric power	80.6	87.0
Manufacturing and retail	194.7	200.0
Total at American points	445.5	460.0
Exports	27.8	25.0
GRAND TOTAL	473.3	485.0

[1] U. S. Bureau of Mines.
[2] Estimate.

proximated 200, but with the second half being 22 percent higher than the first. Coal which had not reflected the full impact of the defense program had a 14 percent greater use in the second as against the first half of 1950. The larger the expansion in defense preparation and the more serious the emergency becomes, the greater will be the dependence upon coal as an energy source for the American economy.

Bituminous production exceeded requirements sufficiently to permit consumer stocks to reach comfortable levels by the close of 1950. Stocks were 45,000,000 tons on January 1 and were built to about 70,000,000 tons during the 12 months that followed. Based upon consumption during the last half of 1950, stocks of 70,000,000 tons represent 50 days' supply. The foresight of building coal stocks to high levels at the start of World War II, when men and transportation had been diverted little to military needs, and fuel requirements had not reached a maximum, had much to do with assuring an adequate fuel supply to the country during the period of that conflict. Coal was the one fuel during World War II that was supplied to meet volume needs even though consumption advanced to record proportions.

Railroads and Dieselization

The postwar dieselization trend of the railroads continued in 1950. This was the major factor in the decline of coal consumption by this class of consumer. The magnitude of the technological change in this field can be seen in the following table:

In yard service, diesels (on a locomotive-hour basis) handled 60 percent of the switching in the first eight months of 1950 as compared to 48 percent for the same period in 1949.

To fuel the growing number of diesels, some 30 percent more diesel oil was consumed in the period considered in 1950 over 1949 as indicated in the table below.

It is interesting to note that on a volumetric basis there was a gain of only a little over one percent in total liquid fuel consumed by locomotives for the periods considered.

Freight hauled by the railroads increased only two percent for the eight months' periods under comparison. Passenger haulage actually decreased six percent. Figures for the first eight months of the year are all that are available at time of writing, so the above do not reflect the last third of the year increases.

Coke and Steel Up

The 1950 production of steel should be 97,000,000 ingot tons. This is a record year, being almost eight percent larger than any previous year. In addition, the capacity of the steel industry is to be expanded at least ten percent in the next two years to some 110,000,000 tons. Additional announcements near the end of the year by individual companies seem to indicate an even larger growth.

High percentage of utilization of steel capacity is also assured due to the basic nature of this industry in either a partial or full scale war economy. Coal will share in this expansion since it still is the source for fuel in the blast furnace. Bituminous consumption by this industrial group in the last half of 1950 was up sharply over the first half.

Utilities' Growth Promotes Coal Consumption

One of coal's most rapidly growing markets has been and will continue to be power generation. Electricity sales by utilities are expected to reach 280 billion kwh in 1950. This is a 12.6 percent increase over last year. Each succeeding year has seen new records of production set by this group and their plans indicate a continuation of the process.

Installed capacity of utility generating plants at the end of 1950 will be about 68,900,000 kw. This is a nine percent increase over the same time last year. The recent rate of increase of capacity has been about 600,000 kw per month and is likely to rise somewhat in 1951.

Similar to steel, the power industry occupies a key position in the defense effort. This with the growth of mechanization in American manufacturing

FUEL CONSUMED BY RAILROAD LOCOMOTIVES
FIRST EIGHT MONTHS OF YEAR

	1950	1949	Change
Bituminous coal, millions of tons	35.4	43.7	—19%
Diesel fuel oil, billions of gallons	1.19	.91	+30%
Residual fuel oil, billions of gallons	1.46	1.70	—14%

Source: I. C. C.

COKE PRODUCTION—FIRST TEN MONTHS OF YEAR

	1950	1949	Change
Oven coke, millions of tons	54.79	51.17	+ 7%
Beehive coke, millions of tons	4.41	3.30	+34%
Total, millions of tons	59.20	54.47	+ 9%

Source: Bureau of Mines.

PROPORTION OF CLASS I STEAM RAILWAY FREIGHT AND PASSENGER TRAFFIC PROPELLED BY DIESEL LOCOMOTIVES
FIRST EIGHT MONTHS OF YEAR

	Freight Gross Ton-Miles		Passenger Car-Miles	
	1950	1949	1950	1949
U. S. Total	43.8%	32.5%	57.3%	47.6%
Eastern District	36.4	27.7	47.4	39.5
Pocahontas Region	5.9	.5	24.9	9.0
Southern Region	45.8	37.6	75.4	65.0
Western District	54.3	39.6	60.9	51.0

Source: I.C.C.

will assure maximum utilization of generating capacity. There has been a steady gain in the efficiency of fuel utilization. In 1950 some 1.18 pounds of coal were required to generate one kwh. This compares favorably with the 1.23 pounds in 1949. However, the growth of power sales has been greater than the improved efficiency so that the 18 percent increase in coal demand by power in 1950 is not abnormal and continued growth can be expected. Also, coal sales to utilities have shown a sharp growth in tonnage in the last half of 1950 over the first half.

Large electricity sales and particularly high peak load demands call for utilizing limited existing generating capacity with maximum efficiency. In order to obtain greater efficiency, there was a growing tendency late in 1950 to utilize the higher grade coals in steam generation.

In certain areas of the country residual fuel oil increased its sales over 1949 as a boiler fuel for power plants. Gas consumption increased considerably too.

FUEL OIL DEMAND BY POWER PLANTS
FIRST TEN MONTHS OF YEAR

	1950	1949	Change
Residual fuel oil, millions of barrels	58.0	46.0	+26%
Distillate fuel oil, millions of barrels	4.8	5.0	— 4%

Source: F. P. C.

Much of this liquid fuel is consumed on the eastern seaboard where large quantities of foreign residual oil have been imported. This residual by-product of petroleum refineries was promoted by attractive price cuts. However, the price was increased subsequently and more recently has been approximating parity with coal. Besides the narrowing of the price spread, the threat of war has given coal a more favorable position and some shifts back to it were in evidence.

Manufacturing and Retail Sales

It is figured that 200,000,000 tons of coal were used in manufacturing and sold through retail yards, but the amount handled by each cannot be satisfactorily determined. Data on both categories are estimated compared to complete coverage for all practical purposes on coal consumption by the railroad, electric power, and iron and steel industries.

The Federal Reserve Board Index of Total Industrial Production climbed steadily throughout 1950. The outlook for 1951 is for sustained high levels. Durable manufactures has shown a large rise and is bound to tie in closely with the rising defense effort. Bituminous coal shares in the growth of this important manufacturing element of our economy. From the estimate that the Bureau of Mines makes on industrial bituminous consumption (other than the major groups considered elsewhere in this paper), there has been a sizable increase in the last half of 1950 over the first half. This is in line with the F. R. B. indices.

Oil and natural gas continued to make headway in the retail market where sales are mainly for space heating. Their gains, however, were largely in the acquiring of accounts for newly constructed dwellings. Coal has held much more of its heating business than many had thought previously. It still is the largest provider of heat compared to the several basic fuels and waterpower. A good part of the decline in retail sales in 1949 and the first part of 1950 was due to mild winter weather.

Exports

The majority of the tonnage in this outlet is to Canada. In the first eight months of 1950 Canada had increased her imports slightly over the same period in 1949. On the other hand, France, Italy, and Japan, importers of sizable tonnages in earlier years, cut their U. S. imports drastically in 1950.

BITUMINOUS EXPORTS
FIRST EIGHT MONTHS OF YEAR
Millions of Tons

	1950	1949
North and South America		
Total	14.73	13.01
Canada	13.93	12.33
Europe and Africa Total	.30	8.84
France	.01	3.44
Italy	.03	3.88
Asia and Oceania Total	....	1.38
Japan	....	1.28
Total exports	15.04	23.24

Source: Bureau of Mines.

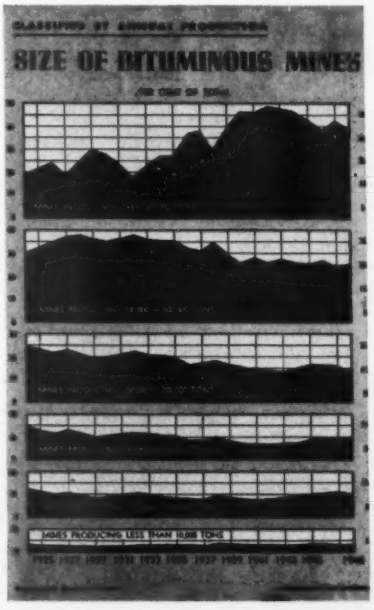
News was coming out near the year end to the effect that Europe would be in a very tight coal supply position and would need tonnage from outside sources in 1951. Increased demand apparently has not been met supply-wise and stockpile depletion was becoming critical. Foreign countries again were looking to the United States to furnish part of their coal requirements.

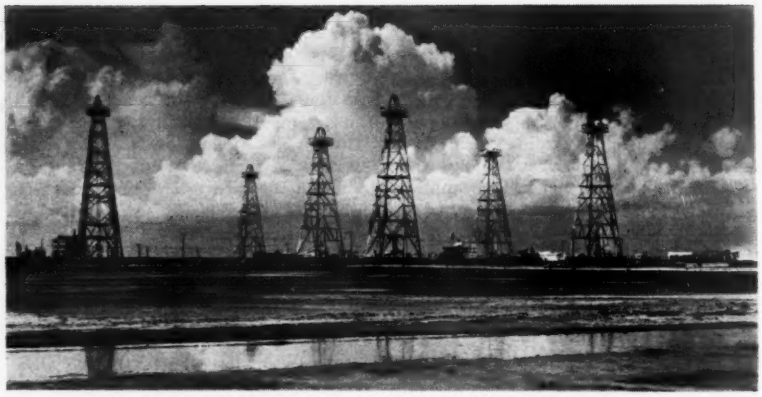
Outlook Points to Growth

The National Bituminous Coal Advisory Council in a report released late in the summer made a series of estimates on future bituminous consumptions. The indications are for higher levels of consumption in 1951, although the figures for that year were qualified since defense activity was hardly under way. A speed-up in activity and the prospects of increased overseas exports, in evidence at the close of 1950, may easily add another 20,000,000 tons to the Council's original grand total. The above table presents their estimates for 1951 and also what might be expected under full-scale war conditions. For comparison, bituminous consumption, including exports, in the last war totaled around 620,000,000 tons in 1943 and 616,000,000 in 1944.

N. B. C. A. C. FORECASTS ON
BITUMINOUS CONSUMPTION
Millions of Tons

	1951	War Peak
Coke and steel	118	125
Railroads (Class I)	60	85
Electrical power utilities	95	134
Cement mills	8	9
Manufacturing and misc.	115	150
Retail trade	90	110
Total consumption	486	613
Exports	25	30
Grand total	511	643





From wells like these came greatest sulphur output ever

Sulphur

Demand Exceeds Record Production as Efforts are Made to Develop New Sources

By R. KIRBY SHIRLEY
Executive Vice-President,
Freeport Sulphur Co.

SULPHUR production climbed to a new record in 1950 but despite the substantial gain in output, requirements for sulphur increased so sharply that the problem of meeting the demand was a serious one as the year drew to a close.

The great bulk of the nation's supply of the element sulphur comes from the salt dome deposits of the Gulf Coast. Although sulphur in one or another form is obtained also from other sources, these deposits supply most of the sulphur for U. S. industry and also an important part of the requirements of our allies abroad.

There are seven Gulf Coast mines now in operation. Six of these are in Texas—the Boling and Moss Bluff mines of Texas Gulf Sulphur Co., the Hoskins Mound mine of Freeport Sulphur Co., the Long Point and Clemens mines of Jefferson Lake Sulphur Co., and the Orchard mine of Duval Sulphur and Potash Co. The seventh—the Grande Ecaille mine of Freeport—is in Louisiana.

Last year these mines, operating at maximum capacity, produced a total of approximately 5,200,000 long tons of sulphur. An additional 150,000 tons of elemental sulphur were recovered from gases, giving a total supply of about 5,350,000 tons. This was approximately 550,000 tons more than was produced from these sources in 1949 and almost double the amount produced in 1940, the last year before the United States became involved in World War II.

The fact that sulphur production is so much greater now than it was in the period preceding Pearl Harbor is the result of the steady and continued growth of the Gulf Coast sulphur industry over the past decade. Plants have been operated at higher capacities, facilities have been expanded, new deposits have been placed in operation, and new sources developed.

The extent of this growth is shown by a comparison of today's production rate with that of the pre-war period 1935-39. The 1950 rate is 145 percent above the 1935-39 average, a production gain considerably greater than the gain by industry in general during that span of time. The Federal Reserve Board index of all industrial production for the year was about 100 percent above the 1935-39 average, and the index for production of minerals was about 50 percent higher.

Demand Rises

The demand for sulphur also reached a new peak in 1950. Approximately 5,500,000 long tons were taken by consumers here and abroad, some 700,000 tons more than in 1949. Of this total, about four-fifths went to domestic users in the United States and Canada, and about one-fifth was exported abroad to the United Kingdom, France and other allied countries.

The excess of shipments over production caused a further reduction in aboveground stocks of mined sulphur. At the year end, producers' stocks at the mines were estimated at 2,400,000 long tons. This was roughly 1,800,000 tons less than stocks at the end of 1940. Thus, while the nation's output of sulphur is much larger now than at the start of World War II, the aboveground tonnage of mined sulphur is considerably smaller. If considered in terms of months of supply ahead, the stocks become even less because of the much higher present rate of consumption.

Although shipments in 1950 reached an all-time high, the total demand—domestic and foreign—was not fully met, particularly in the foreign markets. Furthermore, the rate of demand increased in the latter part of the year, and plans of sulphur consumers for plant expansion indicated still further increases in the rate.

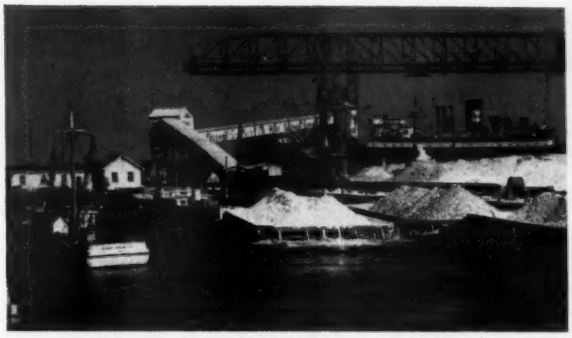
The great increase in the demand for Gulf Coast sulphur during the past decade is a reflection partly of the higher level of industrial activity and partly of the changed world sulphur picture. Gulf Coast sulphur, or brimstone, has been furnishing a larger proportion of the total world supply of the element in all its forms than before World War II. Its share has risen from about one-fourth of the world total to nearly one-half. Foreign production of sulphur and pyrites, both of which were severely impaired by the effect of the war and its economic aftermaths, have not recovered their pre-war position.

Prices Advance

The price of sulphur at the start of 1950 was but little above the average price for the 1935-39 period. At this low price adequate additional sources of supply could not be brought into the market, and in the latter half of the year price advances were made. Freeport, Jefferson Lake and Duval established a new price for domestic customers of $22 per ton at the mine, and Texas Gulf a price of $21.

The price of $22 represents an overall advance of 26 percent above the average price of sulphur in 1935-39. This is less than one-fourth of the corresponding advance in general commodity prices. The wholesale price index of the Bureau of Labor Statistics had risen 110 percent above the 1935-39 average by the end of 1950. The present sulphur prices are also far below the prices of sulphur produced in foreign countries. Italian sulphur has been selling for more than $50 a ton.

The higher prices for sulphur will help not only to prolong the life of present sulphur operations and add to future production and reserves but



Shipments in 1950 reached an all-time high

The cost to build and operate a new mining plant is great

also to counteract some of the factors deterring the development of additional sulphur resources. The cost of finding new deposits in the Gulf Coast region has increased enormously. Wages and prices of materials are much higher, deposits are far more difficult to find, and the search must be made in much less accessible areas. Once a deposit has been found, the cost of building and operating a new mining plant is vastly greater. Moreover, the higher prices also will help to make possible in the long run additional production of sulphur from sources other than the Gulf Coast deposits.

Sulphur Recovery Grows

Recovery of sulphur in elemental form from hydrogen sulphide in sour natural gas, from petroleum refinery gas and from coke-oven gas continued to grow. The amount recovered increased from some 50,000 tons in 1949 to 150,000 in 1950. The starting up of additional recovery plants during the year increased to seven the total number now in operation. These plants now have a combined annual capacity of approximately 260,000 tons.

The largest of the recovery operations is the Texas Gulf Sulphur Co. plant at Worland, Wyo., where sulphur is recovered from natural gas. Other operations are conducted by Mathieson Chemical Corp. at Stamps and Macedonia, in Arkansas, Hancock Chemical Co. at Los Angeles, Stanolind Oil and Gas Co. at Elk Basin, Wyo., Sharon Steel Co. at Morgantown, W. Va., and Freeport Sulphur Co. at Westville, N. J.

Increasing attention was given to sulphur from other sources, the most important of which is pyrites. In 1950 approximately 900,000 tons of pyrites containing approximately 400,000 tons of sulphur were produced by 10 companies operating in eight different states. About 400,000 more tons of pyrites containing about 200,000 tons of sulphur were produced in Canada.

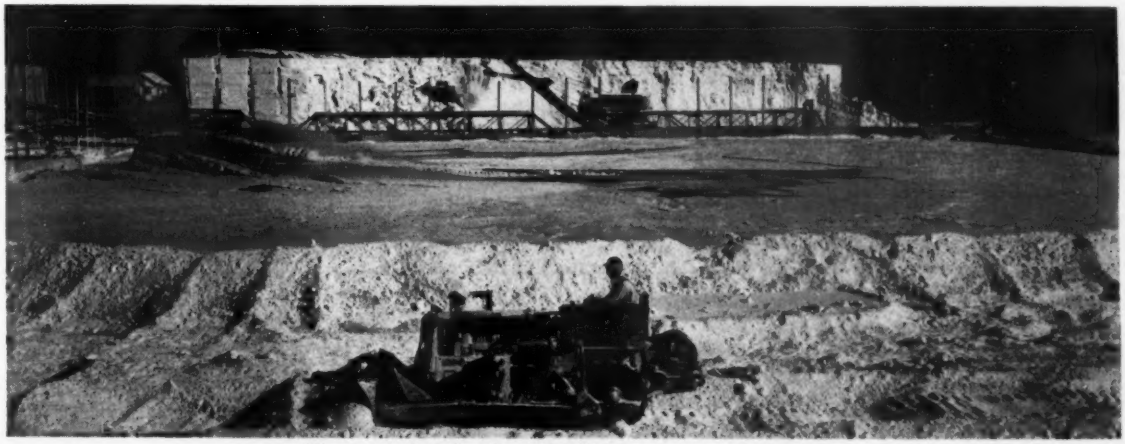
The equivalent of about 175,000 tons of sulphur was derived in the form of sulphuric acid obtained as a by-product at zinc and copper smelters. Twelve companies carried on such operations at 18 smelters located in 11 different states. The equivalent of 100,000 to 125,000 more tons of sulphur in this form was produced in Canada. In addition, the equivalent of small quantities of sulphur was obtained in the form of sulphuric acid from acid sludge, of sulphur paste from hydrogen sulphide, and of acid from hydrogen sulphide. If all these are included, there are more than 50 U. S. companies engaged in obtaining sulphur in some form from its various sources.

Outlook for 1951

Under the pressure of mobilization and defense orders, demand for sulphur in 1951 is expected to exceed even the record level of 1950.

In the face of this anticipated demand, every effort is being made to increase the nation's supply. The sulphur mining companies are—and have been—plowing back large sums of money in the search for new deposits. Additional sums are being spent on attempts to obtain sulphur from sources other than natural deposits.

The U. S. Department of Commerce has requested the sulphur industry to export 200,000 tons of sulphur during the first quarter of 1951, which represents about 70 percent of actual exports in the corresponding quarter of 1950. Although the expected U. S. production of sulphur for 1951 is sufficient to take care of the normal requirements of domestic consumers, the need to supply sulphur to our allies abroad has made it necessary to allocate sulphur in the domestic market also. The industry will be able, however, to supply a high percentage of the total demand for this raw material so vital to our national security.



Aboveground stocks of mined sulphur at year's end were low

AEC Raw Materials Program

1950 Development Described—Favorable Areas for New Mines Cited

By STAFF MEMBERS, USAEC

AS in past years, the AEC is largely concerned with uranium deposits; interest in thorium deposits is much less intense. The commercial or near-commercial uranium deposits in the United States may be grouped in two general geologic categories—the primary uranium-bearing vein deposits, and deposits in sedimentary rocks. The significant deposits of the latter type include the (1) carnotite, (2) copper-uranium, and (3) uranium carbonate deposits.

In discussing these, some of the properties on which new developments have taken place are described as examples of those that are currently receiving attention. This article is not intended in any way as a catalog of present or potential producers.

Vein Deposits

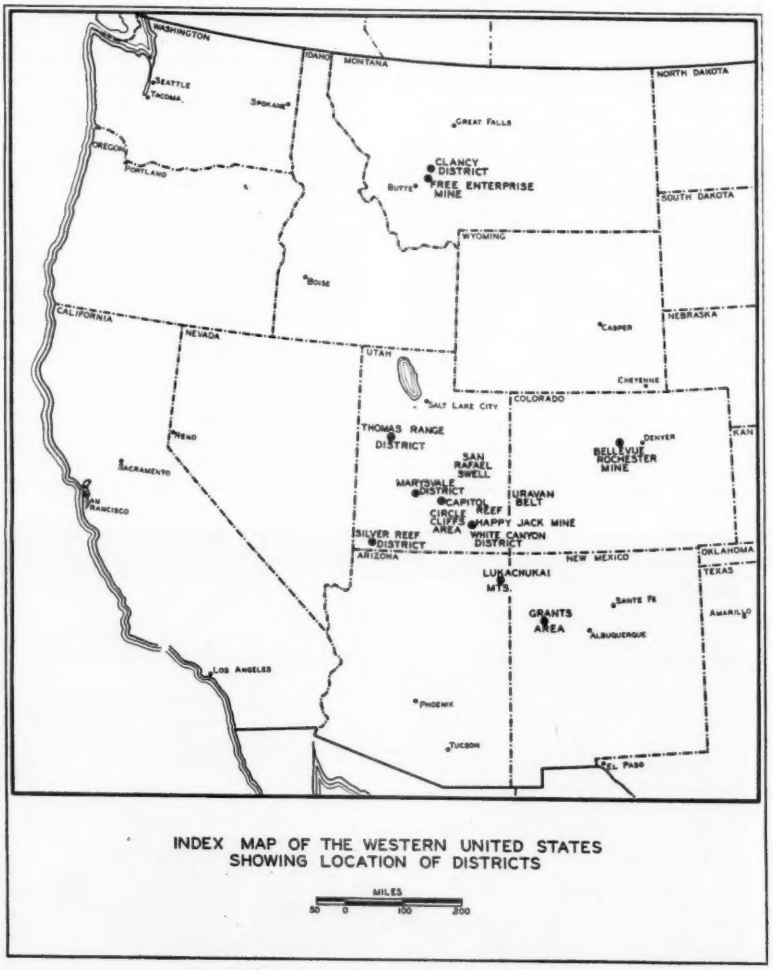
Perhaps the most significant uranium-bearing primary vein deposits explored in 1950 are those of the Marysvale district, Piute County, Utah (see Fig. 1). These deposits are located at or near the contact of a Tertiary granite-quartz-monzonite stock and a series of later Tertiary volcanics that are largely rhyolite agglomerates in the immediate district (see Fig. 2). First discoveries were made on the Prospector claims in the spring of 1949, however, the "central producing" area comprises the Farmer John claim of the Bullion-Monarch Mining Co., the Prospector and Freedom claims of the Vanadium Corp. of America, and the Buddy claim or Bertleson property. Early in 1950 a station was established in Marysvale by the USAEC, and ore from the area has been stockpiled.

In general, the Marysvale deposits are contained within vein-filled fractures in the quartz monzonite. These near-vertical fractures have a general northeasterly strike and are individually traceable on the surface for only a few hundred feet. Surface uranium minerals are mostly hydrous sulphates, phosphates and silicates of uranium associated in and near the veins largely with quartz, less commonly with fluorite, and scattered calcite. In the Prospector vein, development to the 200-ft level has exposed primary minerals in the vein below a depth of approximately 70 ft.

Concentrations of uranium minerals in the Marysvale district are spotty and insufficient portions of the veins have been exposed to allow reliable estimates of ore reserves. To obtain a three-dimensional "picture" of the ore-bearing structures as quickly as possible, the USAEC is currently contracting for the operation of five diamond drills to explore producing ore bodies in the central properties.

Efforts to extend the Marysvale district by new discovery continue. Zones of hydrothermally altered quartz monzonite near contacts with volcanic rocks are receiving particular attention. Continued study of the highly oxidized deposits at the surface in relation to the primary ore at depth will assist in guiding the surface prospecting in the future.

Other promising new developments in exploring uranium-bearing vein deposits have been taking place in the Boulder batholith area of Montana, (see Fig. 1). Several radioactive veins traversing the quartz monzonite country rock have been partially explored. One district showing economic promise is located on the prominent ridges west of Alhambra Hot Springs, near Clancy, in Jefferson County, Mont. Here, particularly on the President



INDEX MAP OF THE WESTERN UNITED STATES SHOWING LOCATION OF DISTRICTS

Fig. (1) Significant deposits found in five states

and W. Wilson claims, steeply dipping silicified shear zones with diverse strikes contain erratic concentrations of uranium minerals, largely secondary at the surface, but including some pitchblende. Some of the vein material is of ore grade, but determination of the size and shape of possible minable ore bodies must await development activities such as the current work of the Newmont Mining Co. Adits and drifts are being driven beneath the more promising surface segments of the veins on the W. Wilson and President claims.

Another interesting deposit of this type is in the Free Enterprise property, near Boulder, Jefferson County, Mont. (see Fig. 1). Secondary uranium minerals occur here in small irregular concentrations in and adjacent to a narrow silicified fracture zone in quartz monzonite. Mining has progressed continuously during the past year following discovery of uranium minerals on the dump from an abandoned 80-ft shaft. This shaft has been deepened to 150 ft and a small amount of development work done. Several "pockets" of high grade silver-uranium concentrations have been opened on the 80-ft level, and although the measurable tonnage is limited, work is continuing on this level and adjoining claims.

In general, throughout the Basin and Clancy districts, a number of base metal lodes contain at least small amounts of uranium associated with sulphides. For the most part, radioactivity is confined to paper-thin seams and coatings of sooty pitchblende. Present showings indicate that the uranium occurs sporadically along the controlling structures and is generally low-grade across a mining width. Some uranium-bearing material has been found on dumps of abandoned mines where surface outcrops of the base metal veins have not been found to be appreciably radioactive. A number of individuals and private companies have plans for exploring further some of these showings.

Fluorite Deposits

Uranium-bearing fluorite has been known for a number of years to exist in the Jamestown, Colo., Wah-Wah Mountains, Utah, and other districts. Heretofore, however, the uranium content of the fluorspar ores from these areas has been found to be too small and sporadic for economic recovery. During the summer of 1950, field parties of the U. S. Geological Survey have engaged in detailed studies of certain fluorite deposits in the Thomas Range, Juab County, Utah (see Fig. 1) and have blocked out modest ore reserves.

The Thomas Range fluorite district is in a belt of sedimentary rocks between the rhyolite that underlies the western part of Topaz Mountain on the east and other volcanic rocks on the west. Fluorite replaces parts of the intrusive rock and the limestone. The uranium is in finely divided uraninite, disseminated through the fluorite. Beneficiation tests on the ore are currently being performed.

The Colorado Plateau

Carnotite occurrences and their distribution in the Salt Wash member of the Morrison formation of the Colorado Plateau area are comparatively well known and discovery and development of ore there does not ordinarily constitute news. When, however, new ore is found in localities of only minor previous interest, and when it portends an appreciable tonnage of mill grade ore, then it is news. Such a development has taken place in the Lukachukai Mountains district, Ariz., within the past year (see Fig. 1).

Throughout the fall of 1950, the Atomic Energy Commission has been engaged in a drilling program, aimed at the development of several favorable sectors. The deposits of this district are of the carnotite-vanoxite type, and are found in small tabular to lenticular bodies that are distributed in several zones, ranging from 30-120 ft above the base of the Salt Wash member.

Development work in the Lukachukai Mountains has been costly because of the difficulties of constructing access roads. The area is flanked by sheer cliffs of Wingate sandstone, and extensive blasting is required for road construction. Now that roads have been opened into the mountains, it is anticipated that an appreciable tonnage of ore will ultimately result.

The Temple Mountain district on the east side of the San Rafael Swell, in Utah (see Fig. 1), has been producing uranium ore for several years. In the period prior to 1950, shipments from the district were small, and reserve estimates have minimized the total potentiality. During 1950 the total number of operators in this district has more than doubled, and the tonnage of ore produced has greatly increased. Development work in the form of wagon drilling has been started by the Consolidated Uranium Mines, Inc., in the southern part of the district. A second ore horizon has been found below the present workings and four new ore bodies have been developed back of the old workings. Recent discoveries indicate a promising future for the district.

Copper-Uranium Deposits

The "copper-uranium" deposits of southern Utah and northern Arizona received increasing attention throughout 1950 and are scheduled for intensive study during 1951. About 40 properties containing deposits of this type have been described. The deposits consist of concentrations of copper-uranium, and iron minerals in sandstone and shale beds, all of which lie within a few feet, stratigraphically, of the contact of the Shinarump and Moenkopi formations of Triassic age. Surface exposures of this contact extend for several hundreds of miles in the San Rafael Swell, Capitol Reef, Circle Cliffs, Silver Reef, Circle Reef, and White and Red Canyon areas of southern Utah and southward into northern Arizona (see Fig. 3). Copper-uranium deposits are known to occur at selected spots along or near this contact in nearly all areas that have been thoroughly prospected. Large segments of the exposed contact in inaccessible parts of the area are totally unprospected, however, and constitute an exploration challenge.

Most of the known copper-uranium exposures are along the rims of plateaus or mesas and, in the semi-arid or arid climate of the region, have been highly oxidized. In general, thin coatings of secondary green, greenish-yellow, or powdery black uranium, copper, and iron minerals, among others, typically fill the interstices of the sandstone and conglomerate of the Shinarump formation, or are distributed along parting planes of the Moenkopi shale. The major uranium minerals have been identified as torbernite, zeunerite (a hydrated arsenate of copper and uranium), and johannite (a hydrated sulphate of copper and uranium). The main copper minerals are generally malachite and brochantite.

In the Happy Jack mine, White Canyon, Utah, the only present producer among the copper-uranium deposits, sufficient development work has been done to expose unoxidized parts of the

This significant article gives an insight into the trends and general status of the domestic raw materials program for atomic energy. It describes the areas and types of deposits on which major domestic exploration efforts have been expended. A few of the new developments are discussed.

ORE PRICES IN MARYSVALE AREA

In the Marysvale, Utah, area USAEC contracts provide for acceptance of development ore containing as little as 0.1 percent U_3O_8, provided deliveries average about 0.15 percent. Previously minimum grade acceptable was 0.20 percent U_3O_8 with an average of 0.30 percent.

The development allowance for these low grade ores is set so payment for ores containing 0.10-0.20 percent U_3O_8 will be $2.50 per lb of contained uranium oxide. This arrangement applies only to ores extracted during the prospecting and development stage of operations.

ore body. Such primary minerals as pitchblende, pyrite, gersdorffite, chalcopyrite, covellite, chalcocite, and bornite have been identified. The grade of these primary ores is generally considerably higher than that of the oxidized ore at the rim. This transition from oxidized ore of low grade into higher grade primary ore is a significant factor in evaluating the potentialities of the copper-uranium deposits as a whole. Continuing efforts are being made to develop "other Happy Jacks."

The copper-uranium deposits of Utah and Arizona may be grouped into five general districts: (1) the White Canyon-Red Canyon area of San Juan County, Utah, (2) the Capitol Reef-Circle Cliffs area of Wayne and Garfield Counties, Utah, (3) the west side of the San Rafael Swell area, Emery County, Utah, (4) scattered deposits in Washington County, Utah, largely in the Silver Reef district, and (5) the Navajo Indian Reservation areas of southern Utah and northern Arizona. Underground workings from adits, totalling only a few hundred feet, have been driven in only a few of these deposits—largely in the Happy Jack mine. Thus, development of the known deposits is barely in the initial stage.

In addition to a need for adequate development, a large amount of actual prospecting of exposures of the Shinarump-Moenkopi contact yet remains to be done, with excellent chances for discovering new deposits. In general, the unprospected exposures are in the most inaccessible parts of southern Utah and northern Arizona, including such areas as the canyon country near the Colorado River between Moab and Hite, Utah, the eastern flank of the Circle Cliffs anticline, and areas south of Red Canyon adjacent to the Colorado and San Juan Rivers. These are virgin areas that would appear to offer great promise to the prospector.

Uranium Carbonate Deposits

Recently uranium deposits have been discovered in the Todilto limestone formation of Jurassic age along the northeast flank of the Zuni uplift in Valencia and McKinley Counties, N. M. Within this thin formation, which caps the Wingate formation in the area north and northwest of Grants, N. M., concentrations of the secondary uranium minerals including the uranium carbonate rutherfordine and minor carnotite, have been noted in fractures at a number of localities. Thorough sampling and appraisal by geologists of the USAEC and the Atchison, Topeka, and Santa Fe Railway were under way at the end of 1950. Should deposits of this type in the Todilto formation prove commercial, many more miles of exposure of the formation around the Zuni uplift offer favorable chances for prospecting and the discovery of similar new deposits.

The foregoing examples of the types of deposits on which exploration efforts are being expended indicate the wide variety of uranium mineral concentrations where there are hopes of developing commercial ore bodies. Efforts will continue toward the discovery and exploration of all possible

URANIUM DEPOSITS IN THE SHINARUMP AND MOENKOP FORMATIONS
SOUTHERN UTAH

Copper-Uranium Deposits of the White Canyon and Red Canyon District, San Juan County

13. Happy Jack mine (including El Capitan Claim)
39. Hideout Claims
38. W. N. (Shumway) Claims
35. White Canyon No. 1 Claim
40. Fry Canyon No. 4 Claim
31. Scenic No. 2 Claim
14. North Point Claim
33. Black Diamond Claim
37. Four Aces Claim
34. Chandler Group
41. Found Group
36. Surprise Claim
42. Horseback Claim
43. Fry Canyon No. 2 Claim
8. Posey Group
44. Red Canyon No. 1 Claim
45. Slumway Claim
46. Scotty Claim
5. Horse Creek Claim
22. Moody Claim

Copper-Uranium Deposits of the Capitol Reef-Circle Cliff Area, Wayne and Garfield Counties

21. Oiler Tunnel (Bluebird No. 1-5 Claims)
1. Oak Creed Prospect
2. Blue Jay Prospect
6. Hot Shot Claims
3. Falling Star Claims
4. Match Claim

Non-Carnotite Uranium Deposits in the Shinarump Formation-San Rafael Swell Area

23. Lone Tree Claims
24. Dalton Claims
25. Dexter Claims
26. Wickiup Claims
27. Hertz No. 1 Claim
28. (Pay Day Claims (Green Vein Claims
29. Dirty Devil Mines

Sedimentary Uranium Deposits of Washington County

15. Chloride Chief Claim
17. Rough Rider Claims
19. Tecumpseh Mine
30. Duffin Mine
18. Silver Leaf Prospect
16. Fort Pierce Claims

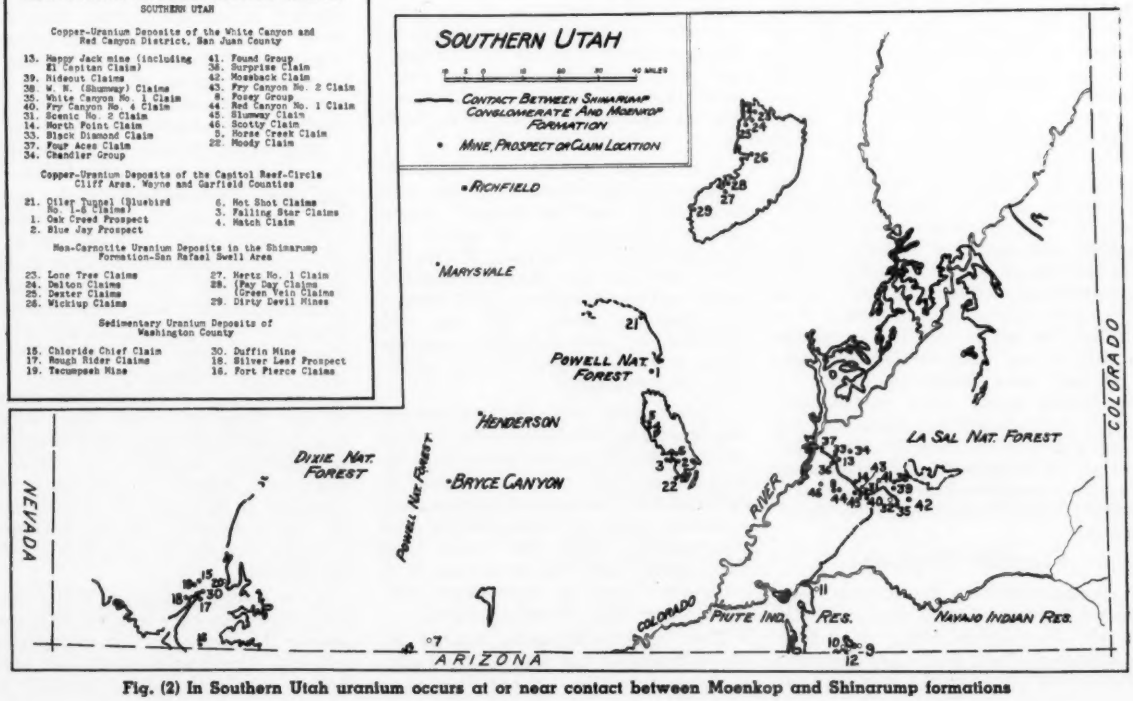


Fig. (2) In Southern Utah uranium occurs at or near contact between Moenkop and Shinarump formations

types of uranium deposits in all areas where there is a reasonable element of geologic promise.

The search for, and development of, uranium-bearing vein deposits, with their promise of high-grade pitchblende ore, has occupied much time and effort, and will continue to do so. Perhaps the first requirement of a sound domestic exploration program is to pursue all avenues in the establishment of such sources. All of our hopes, however, must not be centered in this phase of the program. Most primary uranium-bearing veins in this country appear to be associated either with Tertiary igneous intrusive bodies in the western Cordillera region or are located along the western or southwestern margin of the Canadian Shield. To date, no major quantities of pitchblende ore have been produced from the rather numerous uranium-bearing veins that are associated with Tertiary igneous intrusive rocks throughout the North and South American Cordillera and the United States is unfortunate in embracing only a very small segment of the uranium-bearing Canadian Shield, in northern Minnesota, Wisconsin and Michigan.

Events of the past year appear to point toward the increasing importance of the various types of uranium deposits occurring in sedimentary rocks. Although these ores may have a lower over-all grade than primary ores, their tonnage is, in general, considerably greater. Several trends became apparent as the result of the exploration program in 1950:

(1) The Colorado Plateau carnotite-bearing areas were expanded. Geographically, an extension of carnotite deposits both westward and southward from the area of greatest present productivity has been recorded. Stratigraphically, significant new carnotite deposits have been described in sedimentary rocks as young as Cretaceous in age and as old as lower Triassic. Emphasis on the Salt Wash member of the Morrison formation may, therefore, become less pronounced.

(2) The copper-uranium deposits show promise of possibly becoming a significant factor in our domestic production of uranium. In the Happy Jack mine oxidized ores of low grade are known to pass into higher-grade unoxidized pitchblende-sulfide ores away from rim outcrops. The chances of finding more such unoxidized ore at other localities would appear to be good.

AEC ORE BUYING SCHEDULES

For crude ore not covered by USAEC circulars Nos. 1 and 5, special schedules will be set up for each mill based on prices quoted in Circular 5, which applies particularly to carnotite deposits of the Colorado Plateau. Prices paid for purchase of mill concentrates are arrived at by taking into account ore costs and estimated milling costs. All are considered custom mills for purpose of these negotiations.

Ore buying schedules are on the following bases:

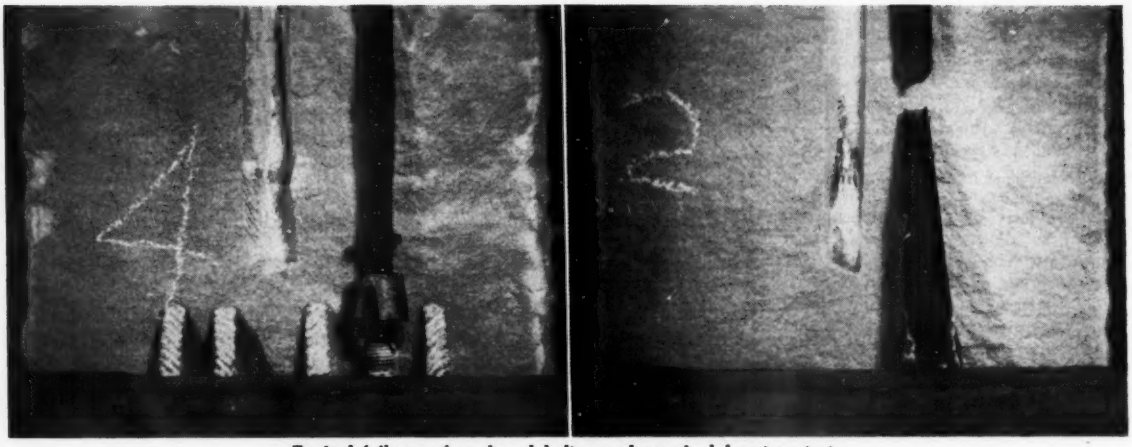
(1) Price of $2.50—$3.00 per lb U_3O_8 content, depending on grade, delivered at a mill. This price includes a development allowance of 50 cents per lb U_3O_8 content.

(2) In addition, a haulage allowance may be granted to cover part of mine to mill transport.

(3) Ore specifications will be established by each mill. Material which does not meet these will be refused. In some cases metallurgical tests may be required to establish acceptability. Minimum U_3O_8 content for an acceptable ore may be set at 0.20 percent where the average is 0.30 percent U_3O_8 depending on type of ore, except in certain cases.

(4) Payment may be made for other valuable constituents of the ore where the mill can recover them economically. In general such additional payments will be based on market value less deductions to cover metallurgical losses and cost of milling, transportation, smelting, refining and marketing.

Uranium ore now processed in U. S. Vanadium mill



Typical failures of anchored bolts as shown in laboratory tests

Overhead Roof Support

Progress Made in Scientific Application of Roof Bolting

By AUREAL T. CROSS
Coal Geologist-Paleobotanist
West Virginia Geological Survey and
West Virginia University

and

PAUL H. PRICE
State Geologist
West Virginia Geological Survey

ADVANCEMENT in the technology of roof bolting in 1950 has been principally that of gaining experience and increasing and exchanging ideas. Very little change in approach is evident from that reported during 1949.

Published literature is principally in the nature of individual success stories, and some of these are little short of amazing. They describe the generally satisfactory results obtained from overhead roof support with various methods and materials under many different conditions. Numerous accounts of new machines, equipment, and supplies and trade journal accounts and leaflets on the subject became generally distributed. Several digests or full accounts of panel discussions, general meetings and lectures on the methods and merits of the practice of roof bolting appeared.

Widely Publicized

Some of the meetings dealing with the principles and practices of this method of roof support which created wide interest were the conference held by the U. S. Bureau of Mines in Washington in January, the Annual Coal Convention at Cincinnati in April, the Rocky Mountain Coal Mining Institute at Glenwood Springs, Colo., in June, the Coal Mining Section of the National Safety Congress at Chicago in October, the Roof Action Committee of the Coal Division, American Mining Congress, at Pittsburgh, and the joint meeting of the Central Appalachian Section of AIME with the West Virginia Coal Mining Institute at White Sulphur Springs, W. Va., in November.

Most of the papers read or topics discussed dealt with accounts of local practices and results in bituminous, anthracite, iron and oil shale mines, accounts of mechanical devices, considerations on health and safety problems engendered by the practice, and relative costs of the method as compared with conventional timbering. A few accounts were released, with reservations, which dealt with some of the basic geologic and engineering concepts of the practice of overhead roof support by staff members of Columbia School of Mines, West Virginia University, West Virginia Geological Survey, and the U. S. Bureau of Mines.

The widespread introduction of roof bolting into representative mines over most of the United States since 1947 has resulted in the planning, development, and testing of numerous devices for penetrating roof rocks and insertion and securing of several types of bolts and pins. The process has progressed from an essentially manual procedure to mechanical methods, some of which are relatively efficient.

Mechanical Devices and Procedures

Several new drill units are designed to drill the proper hole, insert and tighten the bolts in a speedy, coordinated operation with a minimum crew. This roof bolting procedure has in many instances become an integral unit in the face cycle operation in coal mining. New types of drill bits, shanks and auger sleeves for rotary drills allow rapid penetration of the majority of roof rock encountered, although those constituted of sandstones, limestones or shales with embedded hard inclusions still require pneumatic percussion drills.

Split-rod and wedge-type anchoring devices are considered satisfactory by many operators whereas others prefer some type of expansion shell. Length of bolts and types of bearing plates adopted are often the result of chance rather than scientific planning because of the availability of certain materials at the time of introduction of roof-bolting and their subsequent satisfactory performance. In other operations desirable bolt length has been determined by experimentation and studies of roof rock character. Bearing plates

also have been designed locally to sustain strata which normally fail during mining progress.

There is little agreement on spacing, position and angle of bolts, type of metal or wood to be used for bolt stock, anchoring devices and thread form. This is true also of the amount of tension on the bolt when secured or the desirable torque-tension ratio applied to the nut in tightening, and the usefulness of cross members to tie the lower ends of the bolts together. Federal and state mining organizations have set up arbitrary and admittedly tentative specifications for many of these procedures and materials.

New Developments

A few innovations applied during 1950 that could be mentioned are:

(1) The use of multiple section bolts for deeper penetration in roof rocks of low seams. Simple sleeves have been used to allow vertical bolting of more than six feet of strata in 42-in. coal.

(2) Rib and bottom bolting has been introduced in a few places to control sloughing and crushing at critical areas along pillar lines and heaving floor conditions.

(3) Bolting ahead of the face before shooting has been accomplished by cutting manways into the face with ordinary cutters in order to control particularly bad conditions.

(4) Bolts are found to have greater tensile strength after insertion if a quarter reverse turn is applied to the nut after the desired foot pounds torque has been attained in tightening. This has the effect of relieving excessive torque-tension.

(5) A new development allows a single unit to combine face-drilling with roof-bolting.

(6) Improved bits allow rotary drilling in moderately hard roof rock and a spiral auger flange on the drill shank removes cuttings from the hole rapidly. Also vacuum devices for dust control are available. A device for measuring hole diameter has been introduced. An instrument called the "strata-scope," comparable to a device experimented with in British coal fields, enables an engineer to observe superficially some of the characteristics of the roof strata surrounding the hole.

(7) An apparatus was announced which can be used in the rotating, observing and measuring the reaction of a scalar model (materially identical but proportionally smaller than actual condition) to a centrifugal force which has an action equivalent to gravity on the actual roof rock and bolting conditions in a mine.

(8) The nature of the support given by wooden pins inserted in the roof is not entirely understood. Pins from 1⅞-2¾ in. diam have been used. They are generally shaped to fit the hole tightly so they must be driven or turned in with force. Some have been used with slot and wedge at the upper end and/or the lower end. Others have a larger diameter at the lower end to give greater support to timber cross-members between pins. Wooden pins have been used vertically and at an angle. The latter appear to be more secure.

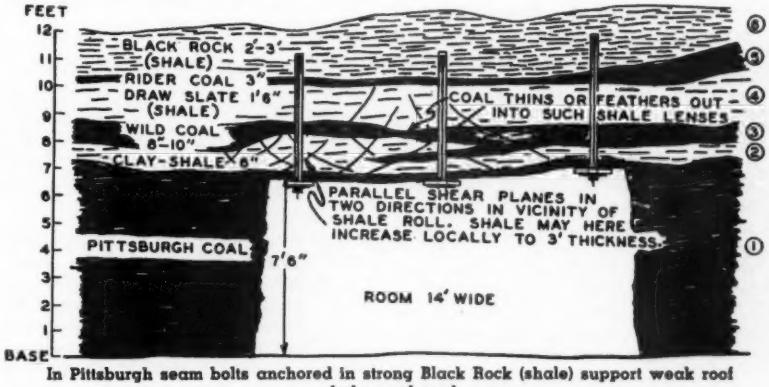
These procedures undoubtedly furnish support similar to that of metal bolts. The increased surface friction throughout the length of the pin should be of some advantage in certain types of laminated strata. It is doubtful that poorly cemented, fractured, or lumpy, irregular roof rock could be as effectively supported, for shearing strength is low. The greater size of wooden pins makes up to some degree for their lower shearing strength. They probably act to prevent or retard lateral movements in the lower laminae, somewhat better than bolts immediately following the removal of supporting rock because of the initial tight fit in the hole. But the greater lateral pressure ultimately exerted will exceed the shear strength of a wooden pin much more quickly than that of a metal pin. It is doubtful if the sliding between bedding or sedimentation planes is reduced by friction between planes as effectively as by bolts, installed with proper tension.

Continued investigations are needed in the use of wood pins and other metal substitutes, in view of potential metal shortages and costs.

Principles of Geology and Engineering Stressed

Knowledge of a number of principles of geology and engineering would be of enormous value in analyzing the conditions to be encountered when a large opening is made from beneath sediments.

In mining, the nature of the action of overhead support is generally considered classifiable in one of three categories. (1) Secure the lower layers of roof rocks to a stronger



In Pittsburgh seam bolts anchored in strong Black Rock (shale) support weak roof shales and coal

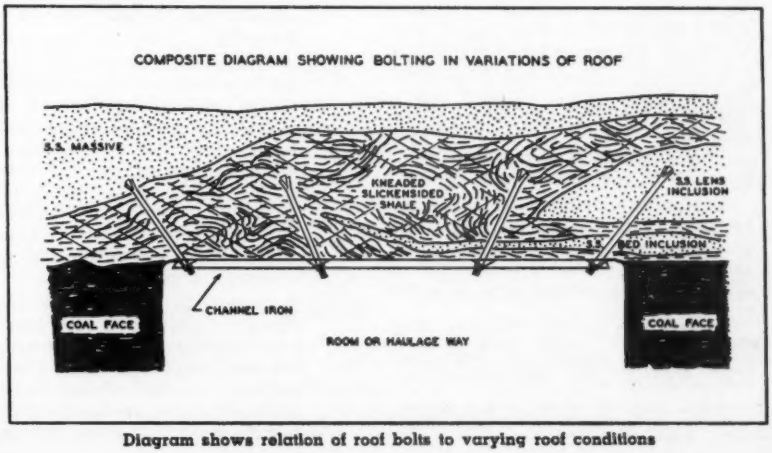


Diagram shows relation of roof bolts to varying roof conditions

stratum above, capable of supporting itself, the added pull below and any pressure from above; (2) Bind enough of the strata or laminas of the roof together to make a multiple-ply beam strong enough to support its own weight and any pressure from above; (3) Increase friction between laminas by binding with bolts or substitute the shear strength of pins for frictional resistance. This will prevent lateral movement from high pressure areas to mined out openings where pressure is lower. Pins or bolts can also serve to lock together disrupted, deformed or broken slabs, blocks and layers.

There has been too little time to carry on adequate scientific experimental work to integrate evidence from recent experience, and to interpret the results concerning the interaction of involved forces on complex rocks. Engineers have had to reconsider a number of early conclusions of the nature of stresses acting upon the roof rocks and some unweighed recommendations for testing materials and installation procedures. Geologists have been puzzled by the unexpected behavior of both complex and simple roof rocks supported by bolts or pins.

Fundamental Research

Two interesting papers reported progress on basic research on roof materials and reaction to various pressure phenomena. One of these demonstrates practical value derivable from theoretical considerations and deals with the study of roofstone behavior and determination of mine structure stresses.[1] Special seismic equipment was used to determine the relation of sub-audible sounds to the few audible noises characteristic of a "working" roof. Results indicated that the noise level is an indicator of redistribution of stresses and that when an elastic limit is approached a considerable increase in noise occurs.

Factors affecting subsidence or sag were investigated and such action was found to be of two sorts: immediate major subsidence followed room widening and independent of this constant and relatively small sag apparently due to plastic flow. Blasting has a distinct but as yet undefined effect on subsidence rate. Noise-level and roof sag show directly proportional relationships to operational procedures.

A third major goal in these researches was to determine absolute pressures in mine structures. From these studies it appears possible to determine such critical data as width of rooms, sizes of pillars, roof pressure to be supported, etc.

A second basic paper which should be noted was presented at the Annual Coal Convention in Cincinnati.[2] A somewhat oversimplified presentation of some of the geological structural elements that affect roof bolting practice was made. The limitations of mathematics and of the elastic theory in solution of stress and failure problems which occur in the mines may be overcome to a certain degree by studying performance of scale models under properly adjusted and controlled forces.

A number of tests on strength of bolt anchors and anchor efficiency were conducted by G. R. Spindler and D. T. Worrell, School of Mines, West Virginia University. One of the results was to show some of the sources of error in measuring torque-tension with electric strain gages. Bending of the bolts during insertion apparently reduces their strength according to these findings.

The complex condition of most roof rock in mines affords a set of variables most difficult to visualize. Basic geologic studies in petrography, sedimentation and structure must be stepped up in order to supply engineers with adequate data to work out basic stress patterns and methods of shifting stresses away from the scene of mining operations.

Basic Problems

A number of suggestions can be made here for much needed research and investigation as a result of the difficulty in interpretation of interacting forces and desired counteraction of roof bolting:

(1) Studies by competent geologists which will lead to establishment of basic types of roof rocks encountered in each field. In conjunction with mining engineers they could formulate adequate means of identifying and bolting each type as it is encountered. This is needed in areas where the roof rocks are irregular.

(2) A better method of determining in advance the three dimensional position and extent or magnitude of fault zones, local shears, lenticular inclusions and other irregularities in roof strata. This can probably be found in an adaptation of one of the electronic instruments now used in geologic work or in the metal industry.

(3) A method to determine in advance the amount of roof pressure in order to control it with adequate support. This is especially needed where thick shale sequences overlie the economic rock; in areas where faulting has developed lines of weakness; where overlying mine workings have caused pressure irregularities below or where great irregularities at the base of overlying sandstone cause major inequalities in distribution of pressure on less competent beds below.

This also might be solved through the use of some electronic device or an adaptation of an electric strain gage.

(4) Basic investigations on the inherent petrographic constitution of the roof strata for predicting swelling, sagging, shearing or aggregate micro-movements of the strata in order to interpret interaction of lateral and vertical pressure and tension.

(5) Renewed investigation of methods and materials applicable for sealing exposed roof rocks and bolt holes to check oxidation of clay minerals which are often largely responsible for swelling character of roof shales and splitting along planes of sedimentation and to check movement which leaches and weakens roof rocks.

(6) A method of determining where bolts have failed. The present methods of tapping are unreliable and occasionally conditions are encountered where audible and visual evidences of failure are insufficient. This might be worked out concurrently with the study of methods for determining rock pressure in advance. This also is desirable for testing the soundness of the top of the bolt hole which is now done by tapping.

(7) Continued investigation of methods of measuring torque-tension relationship on bolts and of a pull-test device in order to get a more nearly correct determination of relative merits of anchoring devices and rock strength.

(8) Continued investigations on substitutes for metal bolts and methods of reducing corrosion, decay and deterioration.

(9) A device to determine the amount of separation along planes of weakness of the overlying strata to the top of the hole or the competent bed. This could be developed along the same lines as the device for detecting faults and shear zones.

(10) Tests should be conducted to determine scientifically the relative merits of angled vs. vertical bolting, and of the use of individual bearing plates as opposed various types of cross-members.

---

[1] Sipprelle, E. M., and H. L. Teichman. Roof studies and mine structure stress analysis. Bureau of Mines oil-shale mine, Rifle, Colo. Trans. AIME 187, Oct. 1950, Mining Engineering, 1031-36.

[2] Bucky, Philip B. Theory of Roof Bolting. Coal Mine Modernization 1950 Year Book, pp. 13-18. Washington, 1950.

Mining Geology and Exploration

—Photos courtesy National Film Board & Labrador Mng. & Expl. Co.

Continued exploration of Labrador iron deposits brought total reserves to 400,000,000 tons

World Crisis Focuses Attention on Metal Supply

By F. S. TURNEAURE
Associate Professor, Economic Geology
University of Michigan

WITH major emphasis on the short-range program to increase metal output, mining companies and government agencies are working together to put marginal properties into operation and to find new ore. In directing exploration, in the investigation of marginal mines, and in the search for new orebodies, the geologist will make use not only of the older methods of geological analysis but also of newer methods such as geophysics, geochemistry and rock alteration studies.

In this brief summary, it is pertinent to note significant publications that relate to major problems of ore deposition. Fundamental laboratory data were contributed by Kennedy (1), who investigated the system silica-water; at high pressure, the solubility of silica increases with temperature up to the experimental limits (560 C), but at low pressure, its solubility decreases beyond the critical range. The cooling of an ore fluid at low pressure may thus cause an increase in its solvent power and may explain the extreme leaching observed in certain near-surface deposits.

The direction of flow of ore solutions in certain fissure veins can be determined, according to F. Gordon Smith (2), by a study of decrepitation curves of vein quartz; Kennedy (3), however, has questioned the basic premise that the vacuoles contain a true sample of the ore fluid.

Rock Alteration

Sales and Meyer (4) give additional evidence to support their view that the symmetrical zones of alteration along the Butte veins are contemporaneous in origin. The front of argillic alteration advances outward while sericite is being deposited near the vein in the zone of maximum thermal and chemical intensity. Lovering (5) attributes the successive zones to diffusion in an isothermal environment and the reversal in chemical trend in the sericite zone to a break in the alteration process. In certain districts, as noted by Schwartz (6) and Kerr (7), a lack of symmetry in the alteration pattern may reflect well-defined stages in hydro-thermal attack.

Burbank (8) contrasts alteration in the shallow volcanic environment with that of the deeper zones and ascribes the difference to vaporization of the ore fluid when it reaches the shallow zone of low pressure. Other detailed studies have been made of rock alteration at Bagdad, Ariz. (9), and at Santa Rita, N.M. (10).

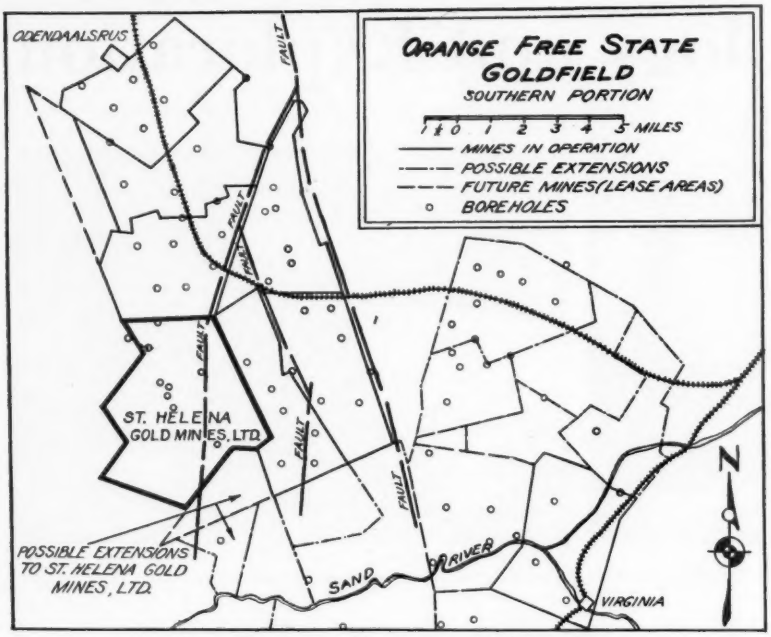
Schmitt (11) regards the shallow "epithermal" deposits as unique in the hydrothermal sequence and emphasizes the role of meteoric water in their formation with the metals contributed from below in a "gas-vapor-sublimate phase." He also presents a classification chart (12) in which a sharper distinction is made between depth and temperature than that implied in Lindgren's classification.

Geochemical Prospecting

Major interest has been shown in geochemical prospecting and a symposium on the subject at the Salt Lake City meeting of the American Mining Congress included a summary by Hawkes and Huff (13). Initial efforts have been directed largely to a correlation of geochemical data with known orebodies (14). Continued study by the principal mining companies and by the U. S. Geological Survey may develop empirical rules for general application.

Exploration in its broadest aspect, the search for new mining districts, is reviewed in thoughtful papers by Nolan (15) and by Wisser (16). Both look to large areas of the West which are covered by late formations as potential areas of metal production. Nolan emphasizes the projection of geological trends and geophysical reconnaissance as initial steps to locate covered igneous belts and cupolas, that would constitute favorable areas for test drilling. Wisser suggests that a more intensive study be made of slightly mineralized areas situated at the edge of the rock cover and of narrow strips of older rock exposed in deep canyons.

The symposium volume on the lead and zinc deposits of the world, published by the 18th International Geological Congress, includes up-to-date summaries of 33 districts by recognized authorities (17). In his summary of the geology of the lead and zinc deposits, Dunham (18) uses a



Orange Free State gold mines expanded operations

five-fold intensity classification, distinguishing the high-temperature ores of the deep metamorphic environment from those of shallower origin.

Uranium Deposits

Several informative papers on uranium deposits have appeared recently. The geology of fissionable materials is summarized by Bain (19); the occurrence of uranium in pegmatites is described by Page (20); and the marine uranium-bearing sedimentary rocks are reviewed by McKelvey and Nelson (21). Data have also been contributed on the "carnotite deposits" of the Colorado Plateau (22) and on the uraninite ore of the Sunshine mine in Idaho (23). Primary ores have been found at Marysvale, Utah (32), where the uraninite occurs in a zone of hydrothermal alteration associated with a quartz monzonite stock.

In an excellent account of the Homestake gold deposits, Noble (24) divides the mineralization into four stages, three earlier and one later than the Tertiary dikes.

Notable additions to the literature on foreign deposits include an article on the lead-zinc ores of the Aguilar mine in Argentina by Spencer (25) and one on the Cobar field, New South Wales, by Joklik (26).

Taxes Deter Activity

Extensive exploration has been carried on during the year by the mining industry, but domestic activity continued to be handicapped by adverse tax legislation. The Mineral Deposits Branch of the U. S. Geological Survey is pursuing an active program which involves some 70 projects in 24 states, as well as cooperative studies in foreign countries. Recent publications of the Survey cover pegmatite investigations in Colorado, Wyoming and Utah (27), the La Plata district of Colorado (28), the manganese deposits of Cartersville, Ga. (29), and the gold deposits of Cripple Creek (30), as well as the results of strategic and foreign mineral surveys. The U. S. Bureau of Mines has been active in exploration and research, especially in connection with strategic and rare metals.

Iron Ore Discoveries

Important news in the field of exploration comes from the iron and steel industry. In a highly informative article, Lake (31) describes the exciting discovery, initial exploration and plans for future development of Cerro Bolivar, the great iron deposit of Venezuela with an indicated reserve of 500,000,000 tons.

Exploration and development of the Labrador iron deposits was continued during the past season by the Hollinger-Hanna interests and reserves now total 400,000,000 tons. A third postwar development is taking place in Liberia, where the Republic Steel Corp. will soon be shipping iron ore from the deposits of Bomi Hills.

In the Lake Superior district, the major operating companies are pursuing an aggressive policy in taconite research; results show that the concentrates can take the place of higher grade ores. Important iron-ore exploration is being conducted in the Lake Superior district as well as in Ontario and Pennsylvania. Aeromagnetic surveys by government agencies indicate a possible southeastward extension of the Vermilion Range in Minnesota; similar surveys in Ontario have located magnetite deposits in pre-Cambrian rocks beneath a cover of Paleozoic limestone.

In the gold fields of eastern Canada, a major strike was made at Newlund Mines, southwest of Sioux Lookout. Kerr Addison at Larder Lake, which has developed better ore in depth, now holds first place among Canadian gold producers. A large tonnage of gold ore has been developed in the Yellowknife district, N.W.T., where exploration has confirmed the estimated displacement of 3.5 miles along the West Bay fault. In the sensational new gold field of the Orange Free State, the St. Helena Gold Mining Co., the first to open up the Basal Reef, is now engaged in lateral development. Drifting in ore has also been started by the Welkom Gold Mining Co. Ltd. Major activity is reported in the Yilgarn gold field, Western Australia.

Base Metal Developments

In the copper industry, the principal news is the continued development of deposits discovered in recent years and the expansion of facilities in the older districts. In Quebec, the Quemont mine had its first full year of operation, and far to the northeast, exploration has been resumed of the copper-gold deposits of the Chibougamau district.

The exploration for lead-zinc-silver deposits is under way at Aspen and Leadville, Colo.; Alta, Utah; Hailey, Idaho; in the Coeur d'Alene district; and in the mineralized belt extending from Metaline Falls, Wash. to Salmo, B. C. Farther north, important developments are reported at Kootenay Lake, in the Slocan district and at Keno Hill in the Yukon. Reconnaissance drilling for lead-zinc deposits along the south shore of Great Slave Lake has given encouraging results. A large area in the old Joplin district is to be re-examined; in southeast Missouri, a new orebody has been developed in which the galena occurs in a dolomite matrix surrounding granite pebbles.

Base-metal production in a number of the older districts of Europe is to be augmented through the aid of ECA funds. At the Mpanda mine in Tanganyika, a pilot mill was started in January; from Uganda, Nigeria, and French Morocco comes news of increased activity in base metals.

Other Metals

Only brief mention can be made of outstanding developments in connection with the other metals. At Lynn Lake, Manitoba, the mining of nickel-copper ore will soon commence. In South Africa, a new company has been formed to develop the Insizwa deposits

containing copper, nickel and platinum. The reduction in manganese imports from Russia has been largely balanced by increased production in the Gold Coast, South Africa and India. In Brazil the manganese deposits of the Amapari River are being investigated as a major source of supply.

The increased price for tungsten should stimulate production from domestic mines as well as in foreign countries, such as Bolivia, Tasmania and Spain. Political conditions in Malaya are extremely serious; exploration is at a minimum and tin production may be curtailed. At Llallagua, in the Bolivian tin belt, the block caving of low-grade ore is now in progress, and metal recovery has shown substantial improvement.

The Blackbird (33) cobalt-copper property in Idaho will soon be in production, and the Howe Sound Co. has announced plans for the construction of a cobalt refinery near Garfield, Utah. The production of aluminum is increasing and significant bauxite deposits are being opened up in Jamaica (34); major developments are under consideration in the Gold Coast, Borneo, and British Columbia. The production of ilmenite from the Allard Lake deposits in Quebec was started during the year. An increase in the demand for zircon, monazite and beryl is reflected in greater activity in the search for rare-metal deposits.

In the event of a serious emergency, the importation of many metals may be sharply curtailed. The United States will then have to depend to a greater degree upon stockpile supplies, sub-marginal deposits, new discoveries in the United States and near-by foreign countries, and substitutes developed through research.

The foregoing summary of exploration in 1950 is based upon information in the technical press together with that supplied in answer to inquiries. The writer is deeply grateful to the many individuals who supplied pertinent material.

References

(1) G. C. Kennedy, A Portion of the System Silica-Water, Econ. Geol. 45, 629-654, 1950.

(2) F. Gordon Smith, A Method of Determining the Flow of Hydrothermal Solutions, idem, pp. 62-69.

(3) G. C. Kennedy, Pneumatolysis and the Liquid Inclusion Method of Geologic Thermometry, idem, pp. 533-548.

(4) R. H. Sales and Charles Meyer, Interpretation of Wall-Rock Alteration at Butte, Mont., Colorado Sch. Mines, Quart. Vol. 45, No. 1B, pp. 261-275, 1950.

(5) T. S. Lovering, The Geochemistry of Argillic and Related Types of Rock Alteration, idem, pp. 231-261.

(6) G. M. Schwartz, Problems in the Relation of Ore Deposits to Hydrothermal Alteration, idem, pp. 197-209.

(7) P. F. Kerr, Discussion of Alteration and Its Application to Ore Search, idem, pp. 327-335.

(8) W. S. Burbank, Problems of Wall-Rock Alteration in Shallow Volcanic Environments, idem, pp. 286-327.

(9) C. A. Anderson, Alteration and Metallization in the Bagdad Porphyry Copper Deposit, Ariz., Econ. Geol. 45, 609-628, 1950.

(10) P. F. Kerr, J. L. Kulp, C. M. Patterson and R. J. Wright, Hydrothermal Alteration at Santa Rita, N. M., Geol. Soc. Am. Bull. 61, pp. 275-348, April 1950.

(11) Harrison Schmitt, The Fumarolic-Hot Spring and "Epithermal" Mineral Deposit Environment, Colorado Sch. Mines, Quart. Vol. 45, No. 1B, pp. 209-231, 1950. Also: Origin of the Epithermal Deposits, Econ. Geol. 45, 191-200, 1950.

(12) Harrison Schmitt, The Genetic Classification of the Bed Rock Hypogene Mineral Deposits, Econ. Geol. 45, 671-680, 1950.

(13) American Mining Congress, Salt Lake City Meeting, Aug. 1950. Abstract, Min. Cong. Jour. Oct. 1950, p. 76.

(14) Papers presented by G. M. Fowler, R. E. Gilbert, and Owen Kingman. Abstracts, Min. Cong. Jour. Oct. 1950. Also: J. W. Harbaugh, Biogeochemical Investigations in the Tri-State District, Econ. Geol. 45, 548-567; T. S. Lovering, L. C. Huff and H. Almond, Dispersion of Copper from the San Manuel Copper Deposit, Ariz., idem, pp. 493-514; R. B. Fulton, Prospecting for Zinc Using Semiquantitative Chemical Analyses of Soils, idem, pp. 654-670; Donald Graf and P. F. Kerr, Trace-Element Studies, Santa Rita, N. M., Geol. Soc. Am. Bull. 61, 1023-1052, Oct. 1950; V. P. Sokoloff, Geochemical Prospecting Methods Bring Results in Australia, Min. Wld., April 1950.

(15) T. B. Nolan, The Search for New Mining Districts, Econ. Geol. 45, 601-609, 1950.

(16) E. H. Wisser, Tomorrow's Ore, Min. Cong. Jour., Jan. 1950, pp. 26-32, 42.

(17) K. C. Dunham, Editor, The Geology, Paragenesis and Reserves of the Ores of Lead and Zinc, 18th Inter. Geol. Cong. London, Proc. Part VII, 400 pp. 1950.

(18) K. C. Dunham, Introduction, idem, pp. 11-39.

(19) G. W. Bain, Geology of the Fissionable Materials, Econ. Geol. 45, 273-323, 1950.

(20) L. R. Page, Uranium in Pegmatites, idem, pp. 12-34.

(21) V. E. McKelvey and J. M. Nelson, Characteristics of Marine Uranium-Bearing Sedimentary Rocks, idem, pp. 35-53.

(22) R. P. Fisher, Uranium-Bearing Sandstone Deposits of the Colorado Plateau, idem, pp. 1-11.

(23) E. J. Thurlow and R. J. Wright, Uraninite in the Coeur d'Alene District, idem, pp. 395-404.

(24) J. A. Noble, Ore Mineralization in the Homestake Gold Mine, Lead, S. D., Geol. Soc. Am. Bull. 61, 221-252, Mar. 1950.

(25) F. N. Spencer, Jr., The Geology of the Aguilar Lead-Zinc Mine, Argentina, Econ. Geol. 45, 405-433, 1950.

(26) G. F. Joklik, Structural and Tectonic Studies in the Cobar Mineral Field, New South Wales, idem, pp. 331-344.

(27) J. B. Hanley, E. W. Heinrich and L. R. Page, Pegmatite Investigations in Colorado, Wyoming and Utah, 1942-1944, U.S.G.S. Prof. Paper 227, 122 pp. 1950.

(28) E. B. Eckel and others, Geology and Ore Deposits of the La Plata District, Colo. U.S.G.S. Prof. Paper 219, 174 pp. 1950.

(29) T. L. Kesler, Geology and Mineral Deposits of the Cartersville District, Ga., U.S.G.S. Prof. Paper 224, 95 pp. 1950.

(30) A. H. Koschmann, Structural Control of Gold Deposits of the Cripple Creek District, Colo., U.S.G.S. Bull. 955a, pp. 19-60, 1949.

(31) M. C. Lake, Cerro Bolivar, Eng. Min. Jour. Aug. 1950, pp. 72-83.

(32) J. W. Gruner, Geol. Soc. Am. Washington Meeting, Nov. 1950.

(33) E. B. Douglas, Blackbird Mine Development, Abstract, Min. Cong. Jour. Oct. 1950, p. 76.

(34) O. C. Schmedeman, First Caribbean Bauxite Development, Eng. Min. Jour. Nov. 1950, pp. 98-100.

Projections of geologic structures indicate areas for drilling

Coal Mine Equipment Sales*

By W. H. YOUNG and R. L. ANDERSON

Respectively, Chief, Bituminous Coal Section, and Engineer-economist, U. S. Bureau of Mines

SHIPMENTS of mechanical-loading equipment for underground use in coal mines in the United States, in terms of capacity, were 5 percent less in 1950 than in 1949. The capacity of mechanical cleaning equipment sold for use at bituminous coal mines was 8 percent less in 1950 than in 1949.

Shuttle car shipments for use in coal mines in the United States decreased 14 percent in 1950 from 1949, while "mother" conveyors increased 15 percent during the same period.

This survey was made possible by the courteous cooperation of all known manufacturers of mechanical cleaning equipment for bituminous coal and manufacturers of mechanical loading and supplementary haulage equipment for use in all coal mines in the United States. Data from various trade journals were also utilized.

Percentage of coal mechanically loaded increased

Mechanical loading units and supplementary haulage equipment "sales in 1950" represent shipments made during 1950. However, less than half of the mechanical cleaning equipment sold in 1950 was placed in operation during that year; the balance will be installed later.

Mechanical Loading

Bituminous coal and lignite mechanically loaded in underground mines decreased from 295,806,285 tons in 1948 to 222,375,882 tons in 1949 or 25 percent. Mechanical loading in Pennsylvania anthracite mines decreased from 15,742,368 tons in 1948 to 11,858,088 in 1949 or 25 percent also.

Table I shows data on bituminous-coal and lignite production by methods of mining and mechanical cleaning for 1948-50, inclusive. The percentage of the total output mechanically loaded continues to increase. During 1950 approximately 77 percent of the total output was either mechanically loaded at underground mines or loaded by power shovels at strip mines. Underground production of bituminous coal and lignite, by methods of loading, is shown in table II. The preliminary figures for 1950 show that 69.3 percent of the underground output was loaded mechanically and the balance,

TABLE I

BITUMINOUS-COAL AND LIGNITE PRODUCTION, BY METHODS OF MINING AND MECHANICAL CLEANING, IN THE UNITED STATES, 1948-50, INCLUSIVE

	1948		1949		1950[1]	
	Thousands of net tons	% of total	Thousands of net tons	% of total	Thousands of net tons	% of total
Surface stripping	139,506	23.3	106,045	24.2	122,000	24.1
Hand-loaded underground	164,206	27.4	109,447	25.0	118,000	23.3
Mechanically loaded underground	295,806	49.3	222,376	50.8	266,000	52.6
Total production	599,518	100.0	437,868	100.0	506,000	100.0
Mechanically cleaned	180,880	30.2	153,652	35.1	181,000	35.8

[1] Preliminary.

TABLE II

UNDERGROUND BITUMINOUS-COAL AND LIGNITE PRODUCTION, BY METHODS OF LOADING, 1948-50, INCLUSIVE

	1948		1949		1950[1]	
	Thousands of net tons	% of total	Thousands of net tons	% of total	Thousands of net tons	% of total
Loaded by machines[2]	253,044	55.0	191,572	57.7	([3])	([3])
Handled by conveyors[4]	42,762	9.3	30,804	9.3	([3])	([3])
Total mechanically loaded	295,806	64.3	222,376	67.0	266,000	69.3
Hand loaded	164,206	35.7	109,447	33.0	118,000	30.7
Total underground production	460,012	100.0	331,823	100.0	384,000	100.0

[1] Preliminary.
[2] Includes mobile loaders, continuous miners, scrapers, and conveyors equipped with duckbills or other self-loading heads.
[3] Included under "Total mechanically loaded."
[4] Includes hand-loaded conveyors and pit-car loaders.

TABLE III

UNITS OF MECHANICAL LOADING EQUIPMENT SOLD TO BITUMINOUS-COAL, ANTHRACITE, AND LIGNITE MINES FOR UNDERGROUND USE, AS REPORTED BY MANUFACTURERS, 1943-50, INCLUSIVE

	1943	1944	1945	1946	1947	1948	1949	1950	Change 1950 from 1949 percent
Type of equipment:									
Mobile loaders	234	286	359	495	486	[1]725	[1]286	[1]289	+ 1.0
Scrapers[2]	15	39	26	35	35	49	18	9	—50.0
Conveyors[3]	1,100	708	861	1,157	987	1,209	541	373	—31.1
Pit-car loaders	1	...	([4])	([4])	([4])	([4])	([4])	([4])	....
Total all types	1,350	1,033	1,246	1,687	1,508	1,983	845	671	—20.6
Number of manufacturers reporting	24	22	25	24	23	22	22	20	....

[1] Includes continuous miners.
[2] Reported as scrapers or scraper haulers and hoists.
[3] Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads.
[4] Canvass of sales of pit-car loaders discontinued in 1945.

* Published by permission of the Director, Bureau of Mines, U. S. Department of the Interior.

TABLE IV

SALES OF MECHANICAL-LOADING EQUIPMENT IN 1950 COMPARED WITH TOTAL NUMBER OF MACHINES IN ACTIVE USE IN PRECEDING YEARS

	Number of machines in active use, as reported by mine operators							Number of machines sold, as reported by manufacturers in 1950
	1943	1944	1945	1946	1947	1948	1949	
Bituminous-coal and lignite mines:								
Mobile loading machines	2,525	2,737	2,950	3,200	3,569	3,980[1]	4,205[1]	289[1]
Scrapers	83	87	87	75	67	56	46	1
Pit-car loaders	321	241	142	93	71	37	17	(2)
Conveyors equipped with duckbills or other self-loading heads	1,226	1,331	1,383	1,521	1,531	1,632	1,483	(3)
Hand-loaded conveyors, number of units	3,191	3,236	3,385	3,470	3,979	4,125	4,312	316
Anthracite mines (Pennsylvania):								
Mobile loading machines	5	12	20	27	25	19	27	..
Scrapers	510	491	548	564	594	643	589	8
Hand-loaded conveyors, number of units[4]	2,701	2,807	3,006	3,233	3,457	3,562	3,618	57

[1] Includes continuous miners.
[2] Canvass of sales of pit-car loaders discontinued in 1945.
[3] Sales of conveyors equipped with duckbills or other self-loading heads are included with hand-loaded conveyors.
[4] Includes pit-car loaders and conveyors equipped with duckbills or other self-loading heads.

or 30.7 percent, was hand loaded into mine cars.

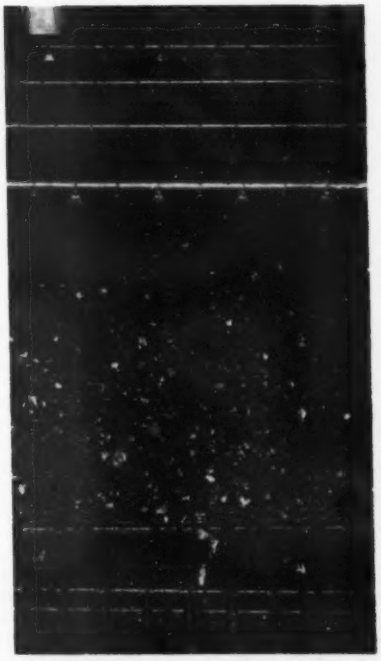
Types of units sold—Table III lists the number of units of mechanical-loading equipment shipped for underground use at all coal mines in the United States, 1943-50, inclusive. Mobile loader shipments, which include continuous miners, increased from 286 in 1949 to 289 in 1950 or one percent. Shipments of scrapers decreased from 18 to 9 or 50 percent and conveyors decreased from 541 to 373 or 31 percent during the same period.

Exports of underground mechanical-loading equipment in 1950, in terms of capacity, amounted to 14 percent of shipments to mines in the United States, in comparison to 38 percent in 1949.

Types of mechanical-loading equipment sold compared with units in use—Table IV shows the trends in demand for various types of mechanical-loading equipment. During the past several years, there has been a substantial increase in the use of all types of mechanical-loading equipment except scrapers and pit-car loaders.

The total number of mechanical-loading units of all types in use at Pennsylvania anthracite mines increased from 3216 in 1943 to 4234 in 1949 or 32 percent, compared with a 37-percent increase at bituminous-coal and lignite mines for the same period.

Types of equipment purchased, by States—Table V shows the number of mobile loaders (including continuous miners), scrapers, and conveyor units shipped to various States in 1950 and the number in use in 1949. West Virginia continued to lead in receiving the greatest number of mobile loaders and conveyors shipped in 1950, followed by Pennsylvania, Kentucky, and Illinois in the order named.



Over 90 percent of the coal was cleaned by wet methods

TABLE V

COMPARISON OF MECHANICAL-LOADING EQUIPMENT IN ACTUAL USE IN 1949 WITH SALES REPORTED IN 1950, BY STATES

	Mobile loaders[1]		Scrapers		Conveyors[2]	
	In use in 1949	Sales in 1950	In use in 1949	Sales in 1950	In use in 1949	Sales in 1950
Bituminous-coal and lignite mines:						
Alabama	147	13	21	..	431	..
Arkansas	...	1	..	..	75	2
Colorado	38	2	1	1	307	1
Illinois	552	20	..	..	14	15
Indiana	167	5	..	..	5	..
Iowa	2	..	..	..	3	..
Kentucky	450	55	..	..	669	51
Maryland	...	..	..	..	38	1
Montana	33	..	..	..	8	..
New Mexico	21	..	4	..	1	..
North Dakota	7	..	..	..	...	..
Ohio	202	12	..	..	149	12
Oklahoma	4	..	..	..	122	..
Pennsylvania	989	76	4	..	932	73
Tennessee	28	2	..	..	214	4
Utah	111	10	1	..	108	..
Virginia	132	..	..	..	204	4
Washington	...	1	7	..	91	..
West Virginia	1,291	89	..	..	2,166	153
Wyoming	31	3	8	..	258	..
Total bituminous-coal and lignite	4,205	289	46	1	5,795	316
Pennsylvania anthracite mines	27	..	589	8[3]	3,618	57
Grand total	4,232	289	635	9	9,413	373

[1] Includes continuous miners.
[2] Includes hand-loaded conveyors and conveyors equipped with duckbills or other self-loading heads.
[3] Includes also pit-car loaders.

TABLE VI—SALES OF SHUTTLE CARS, 1936-48, INC., 1949, AND 1950; AND "MOTHER" CONVEYORS, 1948-50, FOR USE IN COAL MINES, BY STATES

	Shuttle cars			"Mother" conveyors		
	1936-48 inclusive	1949	1950	1948	1949	1950
Bituminous-coal and lignite mines:						
Alabama	181	35	7	6	...	...
Arkansas	...	...	...	...	...	1
Arizona	...	...	...	1	...	...
Colorado	41	10	5	...	3	...
Illinois	290	76	75	14	8	16
Indiana	125	22	15	...	4	...
Kentucky	518	61	94	41	16	24
Missouri	...	1	...	...	...	...
Montana	2	...	...	...	...	...
New Mexico	13	...	...	...	...	...
North Carolina	...	...	...	...	1	...
North Dakota	9	...	...	...	...	...
Ohio	127	15	24	5	3	8
Oklahoma	...	...	7	5	3	4
Pennsylvania	483	143	111	25	13	29
Tennessee	69	2	...	3	...	...
Utah	55	15	20	...	2	2
Virginia	70	5	2	4	3	4
West Virginia	850	155	99	124	59	41
Wyoming	14	3	6	2	1	3
Total bituminous-coal and lignite	2,847	543	465	230	116	132
Pennsylvania anthracite mines	2	...	...	5	...	1
Grand total	2,849	543	465	235	116	133

TABLE VII—NUMBER OF MOBILE LOADERS IN USE IN BITUMINOUS-COAL AND LIGNITE MINES, BY TYPES OF HAULAGE IN EACH STATE, 1948 AND 1949

State	Number of mobile loaders[1]: Loading direct into mine cars		Loading onto conveyors		Loading into shuttle cars		Total number in use	
	1948	1949	1948	1949	1948	1949	1948	1949
Alabama	31	30	63	56	49	61	143	147
Arkansas	1	...	...	...	...	...	1	...
Colorado	16	13	...	1	16	24	32	38
Illinois	380	344	27	11	158	197	565	552
Indiana	111	108	...	...	52	59	163	167
Iowa	2	2	5	...	...	...	7	2
Kentucky	207	175	22	24	193	251	422	450
Maryland	...	...	...	...	1	...	1	...
Montana (bit. and lig.)	31	28	...	...	4	5	35	33
New Mexico	13	15	...	...	6	6	19	21
North Dakota (lignite)	7	7	...	...	...	...	7	7
Ohio	114	108	23	23	58	71	195	202
Oklahoma	...	...	4	4	...	...	4	4
Pennsylvania (bit.)	612	600	84	78	232	311	928	989
Tennessee	6	7	1	...	19	21	26	28
Utah	48	45	8	5	35	61	91	111
Virginia	84	91	4	4	27	37	115	132
West Virginia	791	739	74	97	332	455	1,197	1,291
Wyoming	25	26	...	...	4	5	29	31
Total	2,479	2,338	315	303	1,186	1,564	3,980	4,205

[1] Includes continuous miners.

TABLE VIII—BITUMINOUS-COAL CLEANED IN 1949 AND CAPACITY OF EQUIPMENT SOLD IN 1950, BY TYPES OF EQUIPMENT

Type of equipment	Number of plants in operation[1]	Net tons of cleaned coal[1]	Percent cleaned by each type	Annual capacity of equipment sold in 1950[2] (net tons)
Wet methods:				
Jigs	280	72,422,697	47.1	[3]
Concentrating tables	15	4,039,533	2.6	[3]
Classifiers	82	14,865,261	9.7	[3]
Launders	18	11,238,108	7.3	[3]
Dense-media	104	17,821,524	11.6	[3]
Jigs and concentrating tables	15	3,287,798	2.2	[3]
Other combinations and methods	36	17,033,067	11.1	[3]
Total wet methods	550	140,707,988	91.6	12,300,000
Pneumatic methods	88	12,943,915	8.4	1,100,000
Grand total	638[4]	153,651,903	100.0	13,400,000

[1] Includes plants operated by consumers at central washeries in Colorado and Pennsylvania.
[2] Based on 157 days (average days mines were active in 1949) and 7.0 hours per day.
[3] Included under "Total wet methods."
[4] Includes a duplication of 67 plants using both wet and pneumatic methods; deducting this duplication gives a net total of 571 plants that cleaned coal in 1949.

Haulage Equipment

Shuttle cars—Although the sales of shuttle cars decreased from 543 in 1949 to 465 in 1950 the percentage of the total underground output handled by shuttle cars continued to increase rapidly. In 1944 shuttle cars handled eight percent of the underground bituminous-coal production; five years later, in 1949, the latest year for which data are available, 22 percent was handled by shuttle cars.

Table VI shows the sales of shuttle cars, by States, for the years 1936-48, inclusive, 1949 and 1950. Exports of shuttle cars decreased 11 percent in 1950 from 1949.

"Mother" conveyors—For the purpose of this study, a "mother" conveyor is defined as a sectional, extensible power-driven conveying unit that can handle over 500 ft of conveyor. It may be distinguished as a gathering conveyor, haulage conveyor or main haulage conveyor. Main-slope conveyors are excluded. The last 3 columns in table VI show the sales of "mother" conveyors by States for 1948-50, inclusive. Exports of "mother" conveyors were 40 percent less in 1950 than in 1949.

Transporting coal from mobile loaders—Table VII shows the number of mobile loaders and continuous miners in bituminous-coal and lignite mines by States and types of haulage in 1948 and 1949. The total number in use increased from 3980 in 1948 to 4205 in 1949 or 6 percent, while the number loading into shuttle cars rose from 1186 to 1564 or 32 percent. During 1949, 41 percent of the total bituminous-coal and lignite loaded by mobile loaders was handled by shuttle cars. The remainder of the mobile loader tonnage was loaded onto conveyors (four percent) or direct into mine cars (55 percent). During 1949 approximately 2800 shuttle cars were in use in bituminous-coal and lignite mines in the United States, and about 22 percent of these were of the battery type.

Mechanical Cleaning

Reports from 20 manufacturers of bituminous-coal cleaning equipment show that the total capacity of 1950 sales was 12,200 net tons of clean coal per hour, compared with 13,300-ton capacity sold in 1949, a decrease of eight percent. Sales were made in 12 States and Alaska. Illinois received 30 percent of the total capacity of the 1950 sales, West Virginia and Pennsylvania followed with 26 and 16 percent, respectively.

Table VIII gives data on bituminous-coal cleaned in 1949 by type of equipment in use and also the annual capacity of equipment sold in 1950. Sales in 1950, by type of equipment, show that jigs hold first place, with dense-media and wet tables following.

Top of tailings pile is only 12 ft lower than Florida's highest elevation

Phosphate Rock Industry

High Production Rate Maintained with Bright Outlook for Future

By J. L. WEAVER
Development Engineer
American Cyanamid Co.

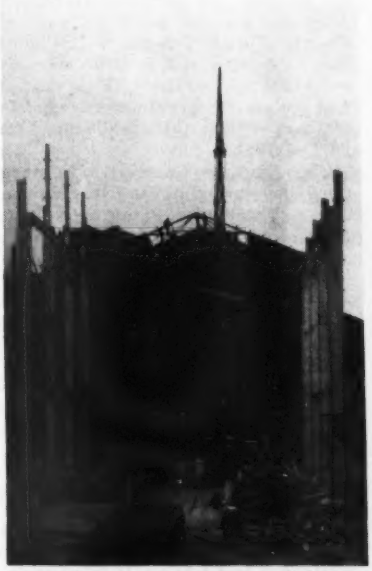
THE production of phosphate rock in the United States, during 1950, continued at the high level attained in 1948 and 1949. In round numbers the estimated production for the year will closely approach 10,000,000 tons. In each of the three major fields supplies of phosphate rock were available and were said to have met the demand. Florida continued to be the major producing area, accounting for better than 75 percent of the total produced; Tennessee was second, closely followed by the expanding western field.

With the North African mines producing at or above pre-war capacity, exports to Europe settled down to about pre-war volume. Exports to Japan increased somewhat over the 1949 volume. However, unless the world picture improves, exports to both Europe and Japan are likely to decrease during 1951.

In all fields the trend toward the production of high analysis superphosphate, at or near the mine, has continued. In 1948 the production of triple superphosphate (45 percent available phosphoric acid) was about 480,000 tons; in 1949 it had increased to 550,000 tons. The 1950 production of triple superphosphate is estimated to exceed 700,000 tons. During the same three-year period the production of superphosphate (18 percent available phosphoric acid) has maintained a fairly even figure at slightly over 9,000,000 tons. Several new triple superphosphate plants are scheduled for operation in late 1951 and production of triple superphosphate during the coming year should approach the 1,000,000-ton mark.

Keeping pace with the expanding production of triple superphosphate is the production of phosphoric acid and elemental phosphorus by the electric furnace method. At least three new electric furnaces are scheduled for operation during 1951.

Research and development, of interest to the entire industry, includes the design and construction of a new type of electric furnace at TVA's plant at Muscle Shoals, Ala. The unusual feature of this furnace is the hearth,



World's largest phosphorous furnace, rated at 25,000 kw. under construction

which rotates slowly. While it is too early to evaluate the operation, TVA engineers expect the furnace to be more efficient and economical than those of conventional design.

Florida Field

The greater part of the Florida production came, as usual, from the land-pebble phosphate field. Relatively small quantities of hard rock and soft rock were produced. The soft rock produced was largely recovered from old hard-rock waste ponds.

The companies mining and shipping phosphate rock in the land-pebble field were: The American Agricultural Chemical Co., American Cyanamid Co., Coronet Phosphate Co., Davison Chemical Co., International Minerals and Chemical Corp., Swift & Co., and the Virginia-Carolina Chemical Corp. In addition to the above mining companies, Armour & Co. operates a triple superphosphate plant and the Victor Chemical Co. an electric furnace.

Early in the year International Minerals & Chemical Corp. announced plans for a $4,000,000 program of expansion and development on a 60-acre site near Bartow, Fla. The program includes plans for erection of a new office building as Florida headquarters for the company; plans for construction of a new plant for the manufacture of multiple superphosphate and phosphate chemicals; plans for the construction of a new large sulphuric acid plant; plans for the construction of a new, modern machine shop, warehouse and service center for all of the company's Florida operations; and plans for erection of a new phosphate division analytical laboratory.

The Coronet Phosphate Co. will move its flotation plant, along with all mining and washing equipment, from the Eleanor mine, Hillsborough County, Fla., to Tenoroc, Polk County, Fla. The new site is some six miles northeast of Lakeland, Fla. Mining and processing operations are expected to start during the middle or latter part of 1951.

The Virginia-Carolina Chemical Corp. has opened up its Clear Springs mine. The mined material is being pumped to their Phosmico plant and processed there.

Early in 1951 the American Cyanamid Co. will complete a new stacker conveyor wet storage installation. Also scheduled for completion in 1951 is a new machine shop and other service units. A village housing project, begun in 1949, now has six houses completed with four more to be completed within the next few months.

The American Agricultural Chemical Co., Davison Chemical Corp. and Swift & Co. continued mining operations in areas previously developed.

In the mining field perhaps the most significant trend has been the investigation and testing of higher head and higher efficiency mining pumps. The successful application of these pumps will allow for more economical hydraulic transportation of the matrix from the mine to the washer and will permit transportation over longer distances.

Cyclones Aid in Separation

In the metallurgical field perhaps the most interesting development during 1951 was the application of large diameter cyclones to effect a sand-slime separation at approximately 150-mesh. The Sydney plant of the American Cyanamid Co. uses six 48-in. cyclones to deslime and size at approximately 150-mesh the washer waste-flotation feed fraction of the matrix. In addition to the elimination of about 20,000 gpm of dilution water, the cyclone slime discard appears to compact more rapidly in the settling system.

In the hard-rock phosphate field the operation of the C. & J. Camp and J. Buttgenbach & Co. was the only producing mine.

The following companies produced "soft rock" or phosphatic clay: Colloidal Phosphate Sales Co., Kellogg Co., Loncala Phosphate Co., Sea Board Phosphate Co., Soil Builders, Inc., and Superior Phosphate Co. In general, these companies mined the fine-grained phosphatic residues in the old waste-pond dumps of earlier hard-rock operations near Dunnellon. Part of this material was sold for use as a phosphatic fertilizer for direct application to the soil and part for use as a filler in commercial mixed or complete fertilizers.

Tennessee Field

The Tennessee field is expected to produce 1,250,000-1,500,000 tons of phosphate rock during 1951. Nearly all of this production will be brown rock phosphate. Companies active in the Tennessee field during the past year were: the Tennessee Valley Authority, Armour Fertilizer Works, Federal Chemical Co., Harsh Phosphate Co., Hoover & Mason Phosphate Co., International Minerals & Chemical Corp., Monsanto Chemical Co., Owens Agricultural Co., and the Virginia-Carolina Chemical Corp.

TVA continued its mining and phosphate processing activities in Tennessee and its chemical plant operations at Muscle Shoals during 1950. The design and construction of a new type of electric furnace, mentioned earlier, was one of their recent developments. A unit for the production of calcined phosphate pellets for electric phosphorus furnace charge was completed. Pellets are made from phosphate, sand and matrix in a rotary tumbler and then calcined in a shaft kiln.

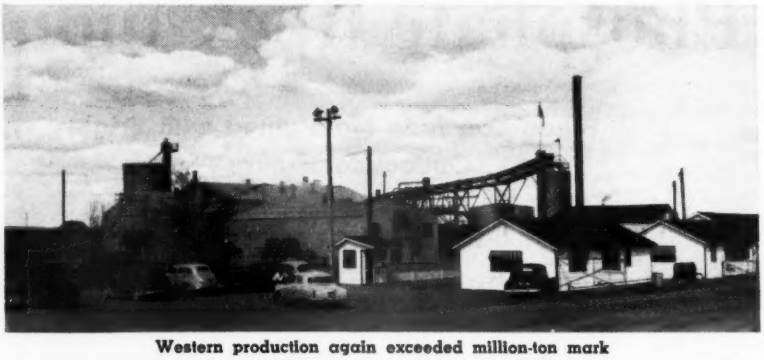
TVA's newest demonstration-scale unit for the production of calcium metaphosphate fertilizer has been in operation for more than a year. The product contains about 62 percent P_2O_5 and is made from phosphorus, air, and rock phosphate, much of which is in the form of fines.

Based on pilot plant results, designs are being prepared for construction of a demonstration plant for the production of nitrogen-phosphate or nitrogen-phosphate-potash fertilizers by processes involving the acidulation of rock phosphate with nitric acid. Some sulfuric or phosphoric acid will be used also; but the main purpose is to substitute nitric acid for sulfuric acid in fertilizer manufacture.

The privately owned companies, listed above, report no new major changes in mining or processing during the past year. However, there has been a general tendency in the whole field to store quantities of matrix near the washing plant, and thus assure a continuous feed during winter months when roads are almost impassable. Also, there seems to be a growing tendency by some of the acidulation plants to use more Florida rock to hasten curing.

In May 1950, the Monsanto Chemical Co. began the construction of a new furnace to be completed and put into operation by January 1951. This will bring Monsanto's total of electric furnaces to six.

The new furnace is said to be the largest phosphorus furnace in the world and one of the largest electric furnaces ever built. It will have a rating of 25,000 kw.



Western production again exceeded million-ton mark

Western Field

The first discovery of phosphate rock in the western states was recorded in Cache County in Utah in 1889. Mining operations were begun on deposits near Montpelier, Idaho, in 1906. Development of the district came slowly and it was 1940 before production of phosphate rock reached 100,000 tons per year. With the utilization of the lower grade phosphatic shales, production increased rapidly and in 1947 exceeded 1,000,000 tons. It is estimated that production in 1950 will again exceed the 1,000,000-ton mark.

The principal mining companies were the Anaconda Copper Mining Co., Conda, Idaho; the Montana Phosphate Products Co., Garrison, Mont.; the San Francisco Chemical Co., Leefe, Wyo.; and the Simplot Fertilizer Co., Pocatello, Idaho. In addition to the above, Gates Brothers, Wendell, Idaho; McIllwee, Paris, Idaho; and the Martin Phosphate Mining Co. continued an active interest in the exploration and development of mining reserves. The Monsanto Chemical Co., a newcomer to the field, has taken an option to buy 3,200 acres of land in the Vernal region of Utah's Uintah Basin. Exploration and prospecting will be carried out over the next two years.

There was little basic change in the mining methods employed by operating companies during the past year. Simplot Fertilizer Co. found that greater selectivity in mining was necessary to maintain proper quality consistently. This company is now making plans for expansion of their plant to include production of high analysis superphosphate fertilizers, along with additional blended mixes. In line with this scheduled expansion, the Simplot Fertilizer Co. is actively engaged in an extended exploration program. Several properties in the Soda Springs-Blackfoot Reservoir area of southeastern Idaho are now under lease from the State of Idaho and the Federal Government, or are owned outright by the company.

The Montana Phosphate Products Co. continued production from underground mines located in the Garrison, Mont., area. The San Francisco Chemical Co. is continuing to develop a surface mining operation at Leefe, Wyo., and the Anaconda Copper Mining Co. is continuing further exploration and development of holdings south of Conda, Idaho. Very excellent technical papers are in print describing the mining methods in use at each of the above properties. Gates Brothers report that their phosphoric acid and triple superphosphate plant, which went into operation in August 1949, has operated satisfactorily. Among the new engineering features used in this plant to reduce capital investment and the manpower requirements were a continuous mixing cone and the use of an Oliver horizontal filter to remove gypsum from phosphoric acid.

Large cyclones were used in sand-slime separation

The Westvaco Chemical Div., Food Machinery & Chemical Corp., will continue to produce elemental phosphorus at its electric furnace plant located at Pocatello, Idaho, where two electric furnaces are in operation and a third is under construction. The elemental phosphorus is further processed into industrial chemicals at plants of the company located at Newark, Calif.; South Charleston, W. Va.; Carteret, N. J.; and at Lawrence, Kans., where a new plant is under construction. In addition the company is organizing a fertilizer development division at Pocatello, Idaho.

The Victor Chemical Works of Chicago announced that it will build a $5,000,000 plant to treat phosphate ores to recover elemental phosphorus at the town of Silver Bow, about ten miles east of Butte, Mont. Initially, phosphate ores will be obtained from the Martin Phosphate Mining Co., operating in the Maiden Rock area south of Butte. The new venture will be the largest industrial plant in the Butte district, outside of the Anaconda Copper Mining Co.

The phosphate industry in the West, though still in its infancy, has an excellent future—both through the use of the material for manufacture of superphosphate fertilizers and chemicals, and for reduction of elemental phosphorus in electric furnaces. In addition, there is still the virtually unexplored field of beneficiation of immense tonnages of low-grade phosphate shales.

New Mexico Air-Drop

MINING has made tremendous strides in transportation since the days when the lowly burro — the prospector's "mountain canary"—did the transporting.

Wagon trains were supplanted by railroads. Then motor transportation came to augment the railroads, still a principal means of hauling heavy equipment and supplies as well as ore from mines to mills and smelters.

Now air service is available to prospectors and small isolated mine operators, through the efforts of Dave Burt, University of New Mexico geology student.

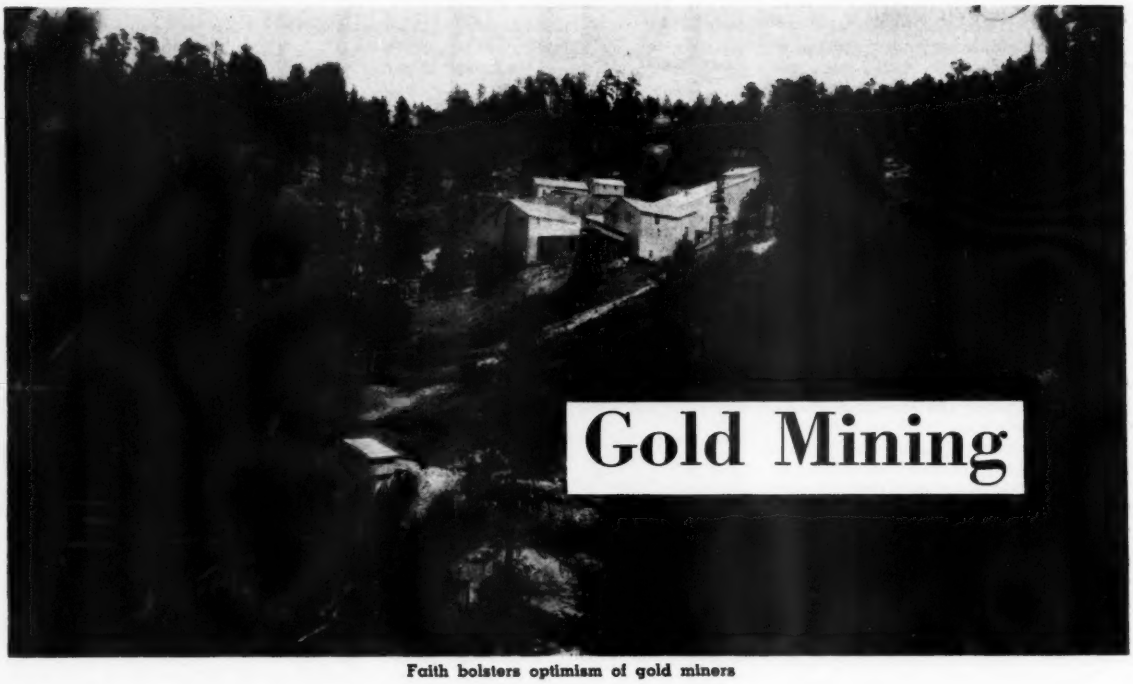
Burt, an Army paratrooper in World War II, has capitalized on his experience, which included also four seasons with the U. S. Forest Service as a smokejumper in fighting forest fires, stunt jumps in the movies and exhibition jumps.

The flying geology student has set up at Albuquerque a parachute cargo-dropping service that makes it possible for prospectors to penetrate areas which are almost inaccessible for long periods of time. It eliminates the necessity of packing supplies over miles of rugged terrain, especially in the winter months when roads and trails are closed.

Aerial service now supplies food, mine supplies, replacement parts for equipment and even medicine, all dropped by parachutes, designed to meet the various needs.

According to Burt, a case of eggs or a 50-gallon barrel of fuel oil can be equally well delivered by parachute.

Although the Albuquerque parachute loft is a new service in New Mexico, it is already beyond the experimental stage in other parts of the United States. For several years the Forest Service has used it successfully in the Rocky Mountain states to fight forest fires, and ranchers are using the service to feed snowbound livestock.



Gold Mining

Faith bolsters optimism of gold miners

Return to Traditional Role Seen Essential

By DONALD H. McLAUGHLIN
President
Homestake Mining Co.

GOLD miners, particularly on this continent, are in a strange situation. As paper currencies continue to depreciate, respect for gold steadily rises. A mine with large reserves of metal in the ground attracts more and more favorable attention. And yet, the margin of profit from gold mining continues to decrease, for costs inevitably rise as inflation advances and payment for the gold the miners produce must be accepted at a fixed price in fiat money. Judgment with regard to investments in the gold mining industry therefore involves a balance between faith in the persistence of the inherent value of gold and acceptance of reduced profits in the period immediately ahead. Eventual correction of this strange situation seems inevitable; but in the meantime, the whole economy is threatened as the inflation, facilitated by avoidance of the discipline of the gold standard, becomes more and more severe.

Faith in the Future

Exploration for gold, in spite of the financial difficulties of many companies, continues to be carried on throughout the world with no loss of boldness and intensity which is a most reassuring sign of faith in its long-range future. Indeed, only an incurable optimist would spend money on the search for gold deposits if he believed that present restrictions on ownership and on the price of gold will last indefinitely and that the money in which he must meet his costs will continue to deteriorate. Exploration in the United States where the current restrictions are most severe has declined, of course, to a low level, though it must be admitted that the record of discovery of important new ore bodies over the past two decades has had a good deal to do with it. On the other hand, prospecting in Canada, though somewhat less intensive in recent years, is still decidedly active and in South Africa, drilling, shaft sinking, and mine development continue at a rate which matches anything in mining history for financial boldness and technical skill—and fortunately for successful results as well.

With free convertibility of gold and the dollar reestablished at a reasonable ratio, discovery of new ore supplies and steady improvements in mining and metallurgy could be expected, as in the past, with good grounds for believing that the gold output of the world would be maintained at a rate adequate in an expanding economy to provide the annual increment necessary to maintain stability of currencies backed by gold. There are no grounds for more pessimism with regard to the future supply of gold than for other metals derived from restricted ore deposits in the accessible portion of the earth's crust. The supply is finite but the prospects for continued discoveries through improved geologic and technical skill are still good and the time when acute shortages of gold will be upon us, at least for mining reasons, is still far ahead. On the other hand, it is equally important to note from the point of view of stability of gold as a monetary base that the danger of an overwhelming flood of new gold from spectacular developments any place in the world is likewise remote.

The mounting inflation of the dollar, of course, must dominate one's thinking about gold mining, as indeed it does about every phase of our economic life. The terrific expenditures for restoration of our armed strength, added to the shocking extravagances of the last five years on top of the dissipation of wealth during the preceding war period, make continuation of deficit financing almost inevitable unless steps are taken that are likely to be too drastic to be entertained politically. In final analysis, this simply

means more and more depreciation of the dollar as the flood of I. O. U.'s of one form or another rises. Controls, imposed with all the dignity the government can command, can achieve only a postponement of the disaster. They treat only the symptoms, while the disease itself gets steadily worse. And the gold miner, unfortunately, does not receive even the relief that such expedients might provide for others, since wages, which are his major expenditure, are usually immune to all efforts to hold prices in check.

Inflation Strikes the Provident

With national expenditures rising rapidly to totals that are far beyond the returns that are reasonable to anticipate from taxes, continued deficits are probably inevitable. Persistent deficit financing with its unavoidable monetary inflation is truly a capital levy. It is a confiscation of a portion of the savings of the people to meet the needs of the government and should be clearly recognized as such. In the face of current dangers, tremendous expenditures will obviously have to be made, and even this painful expedient of a capital levy disguised as further inflation will have to be endured. It should, however, be recognized for what is is and steps taken to check it as part of the great effort required to emerge from the disasters into which the national administration has led us.

Unfortunately, inflation is a very selective confiscation of wealth. It is imposed with particular injustice on the careful, self-reliant members of the community, who have through their savings—retained in bank accounts, insurance, and bonds—endeavored independently and honestly to provide for their own futures. It is also, however, imposed on those who have been forced to contribute their relatively good dollars to social security, with the promise of pensions in their old age. They will undoubtedly get the dollars, but with a substantial portion of their former purchasing power removed.

Discipline of Gold Standard

One essential step in checking this insidious process at this stage would be to bring the nation's finances again under the discipline of gold by restoration of the gold standard. With gold and the dollar interchangeable and fixed at a ratio that would cause the least disturbance to current prices (international and domestic) and that could be maintained, the hands of those trying to keep inflation within bounds would be tremendously strengthened.

Such a solution might be considered merely wishful thinking in the face of the perils that must be met; but, unless we contrive to find some means of honestly and squarely meeting the financial demands—and unless we avoid dissipating our wealth on unproductive or unessential and wasteful ends —there is grave danger of such financial chaos through extreme inflation that the very system of life we are striving to preserve may be destroyed.

What Price Is Proper?

Restoration of the gold standard with the dollar revalued in gold at either too low or too high a price would cause more harm than good. In my judgment, the current price at which the Treasury purchases gold (namely, 35 paper dollars per ounce) is much too low, and reestablishment of convertibility at this level would be even more futile than the effort the British made in the Twenties to resume gold payments at the prewar ratio. On the other hand, an unwisely high price would still further dislocate foreign trade and would aggravate rather than restrain inflation. The proper price is that at which the restored gold standard would have the best chances for functioning smoothly and for bringing the economic world back to a measure of monetary stability. It seems utterly unrealistic to insist, as do our friends of the Gold Standard League or of the Economists' Committee on Monetary Policy, that gold must continue to be priced at $35 per ounce. If this price were a proper one prior to World War II, it surely cannot be right today after all the abuse the paper dollar has suffered. Indeed, if a free gold-dollar ratio could persist unchanged through such a period of deficit financing, it would logically lead one to question the worth of gold itself as a monetary base. It obviously cannot.

Some of us have urged that a free market for gold, as provided by the Johnson-McCarran bill (discussed but not passed last year) would reveal a price within a reasonable time at which convertibility might be restored. Technical difficulties in such a scheme might be serious though not insurmountable. There might, however, be better ways of determining a realistic price for gold; but, whatever they are, the essential need is to restore the gold standard under conditions that will permit it to persist and to be an effective instrument in preserving the economy.

Until it is done, the gold miner can expect even harder and harder times. The inherent value of his ore in terms of depreciating paper money, however, will continue to mount and eventually he will be allowed, I trust, to reap the benefits of his persistent faith in gold. In the end, his confidence that gold will again be permitted to function in the traditional ways for which it is so uniquely suited is sure to be justified and should bring him the rewards that his skill and efforts deserve.

The search for gold still leads men into far places

Silver

Price Jumped to 80c; Domestic Production Rose; Silver Repeal Legislation Imminent?

By Hon. PAT McCARRAN
U. S. Senator from Nevada

UNDOUBTEDLY the most important single event with regard to silver in 1950 was the startling jump in the New York price to 80¢ an ounce and subsequent firmness at that level in the fall of the year. Silver has, at long last, joined in the general commodity price rise.

From 72¾¢ per ounce on October 20 the price rose to 80¢ on October 24th—an aggregate rise of 7¼¢. This is the highest world price since March 1947, when the price reached 86¼¢.

Immediate cause of the abrupt rise in the world price was announcement of the cessation of silver shipments from Mexico. Reports from that country indicated that shipments were halted when it appeared that the Bank of Mexico had experienced a substantial reduction in its silver stocks. The facts seem to bear out this view since the Bank of Mexico has received increasing orders for silver coinage from foreign Governments in the past year. On this particular point the Bank has maintained a discreet silence. The effect of Mexican silver policy on the market has been, once again, forcefully demonstrated.

Another factor bearing on the price rise was the increased domestic demand for silver. The average daily turnover of silver stocks increased considerably in the latter part of the year. The price failed to respond to this increased demand for some time primarily because of substantial quantities of Cuban silver overhanging the market (referred to later).

A late 1950 development, which implies far-reaching but as yet undetermined changes for the silver market, was an announcement by the Bank of Mexico on December 28th that it had retired all silver available to the world market and would seek to sell directly to buyers everywhere. Such a move should reduce considerably the influence that two or three silver brokers have exerted on the market and tend to scatter markets for silver in the future. It is not known at this writing what the pattern of Mexican operations will be henceforth and, therefore, concrete conclusions cannot be formed.

The London official quotation for silver was adjusted to changes in the New York price throughout 1950. The free market rate for domestic and exportable silver adhered very closely to the official price (70d at the end of the year).

The Bombay price for silver fluctuated between 171 rupees and 191 rupees per 100 tolas in 1950 (about 95¢ to $1.06 an ounce), which was less of a spread than occurred in 1949. Toward the end of 1950 the price firmed near the 180 rupee level (about $1.00 an ounce), thereby reversing an earlier weakness. The Indian market remained isolated because of the import ban on silver and continued exchange restrictions.

The price for foreign silver rose to 90.16c per ounce on January 8, 1951, just a shade under the Treasury buying price of 90.5c. This marked the highest level for foreign silver in thirty years. The increase was the first since October 24 last when silver reached a three-year high of 80c. The immediate cause of the 10.16-cent rise was the absence of adequate supplies in the face of a greatly increased industrial demand.

I am pleased but not surprised at the long-awaited upward adjustment in the silver price. I consider the event a rejection of the position taken by silverware manufacturers who have relentlessly sought a low silver price. The improved picture exemplifies the inadequacy of the present Treasury buying price. Domestic silver producers will not be satisfied until they receive the full monetary value of $1.29 an ounce to which they are entitled and which they obtained prior to 1873.

Pat McCarran.

Production

Domestic silver production for the first ten months of 1950 amounted to 34,772,047 oz. It is estimated that production for all of 1950 will be approximately 42,000,000 oz., which will represent an increase of about 8,000,000 oz. over 1949 production. The substantial rise can be attributed largely to the great improvement in metal prices during the year which stimulated the production of the base metals of which silver is a by-product.

As usual, Mexico was the largest producer of silver in 1950 with a production approximating 56,000,000 oz., the amount extracted in 1949.

Industrial Consumption

Industrial consumption of silver in the United States in 1950 is estimated at 120,000,000 oz., an increase over the 90,000,000 oz. consumed in 1949. This increase can be attributed to more prosperous business conditions than generally prevailed in 1949.

Indications are that the present level of consumption will be projected into 1951 although the pattern may change. The demand for silver in essential war uses has not yet been felt, and no doubt this factor will more than take up any slack in the consumption of silver for tableware and other civilian uses.

Seigniorage

"Free" silver in the Treasury as of December 15, 1950 was 162,714,638.1 oz., which represents a decrease from the 171,460,537.3 oz. in this category on December 31, 1949. The reason for the decline is the increase in the amount of subsidiary domestic silver coined (which is taken from "free" silver in the General Fund of the Treasury) over and above the seigniorage silver accumulated as a result of monetization of newly acquired silver.

Silver Movements

Silver imports through November 29, 1950, amounted to 94,683,513 oz. in ore, base bullion, and refined bullion. This amount closely approximates the 95,792,000 oz. in these categories imported in all of 1949. About 60 percent of 1950 silver imports came from Mexico (39,344,343 oz.) and Canada (11,527,845 oz.). The remaining 40 percent was imported from South American countries, the United Kingdom, and the Far East.

Imports of foreign silver coins amounted to $26,880,673 through No-

Subsidiary coinage consumed silver equal to almost half of domestic production

vember 29, which represents a sevenfold increase over 1949. This substantial rise is largely due to the importation of silver coins from Cuba in the amount of $15,465,330.

Exports of refined bullion through November 29, 1950 were negligible (3,035,382 oz.) while exports of foreign coin in the same period amounted to $1,647,248—8 percent of the 1949 figure.

Coinage

Domestic coinage of half dollars, quarter dollars, and dimes during the first eleven months of 1950 consumed 19,019,105.5 fine oz. of silver as compared to 13,515,076 oz. of silver coined into the same denominations in all of 1949. The increased consumption of silver in coinage in the past year was primarily due to the extension of business activity to higher levels than prevailed in 1949.

Reports from Belgium in November 1950 stated that practically all of a Belgian issue of 38,000,000 silver coins have disappeared into hoarding recently. Explanations are vague concerning the reasons for this behavior by Belgian citizens. The National Bank is continuing to issue silver coins, but how long they will be absorbed into private hoards is in the realm of conjecture.

The West German Republic announced in November 1950 that it had purchased enough silver from Mexico (approximately 1,500,000 oz.) to facilitate the coinage of new five-mark pieces, presumably in compliance with a monetary law adopted by the West German Parliament on July 8. The new coins will probably be put in circulation by the spring of 1951.*

Treasury Acquisitions

Acquisitions of newly-mined domestic silver by the U. S. Treasury through November 30, 1950 amounted to 38,169,912 fine oz. This is approximately the amount of the domestic production for the same period.

Cuban Sales

In July the Cuban Government announced it would demonetize about 60,000,000 oz. of silver in the form of pesos and issue paper bank notes in their stead. The move was in line with recommendations of a recent Treasury Federal Reserve Board mission to Cuba.

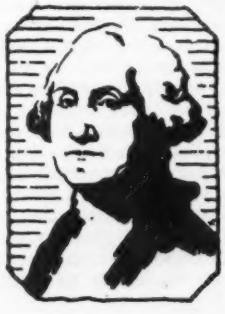
The demonetized silver is to be sold in the New York market over a period of years and in such a way as to not disturb abruptly the operation of the market. It is reported that the Cuban Government will use the proceeds from sales to purchase gold bullion.

Silver Legislation

The improvement in the silver price picture has led some qualified observers to think that silver miners should expect continued and more vigorous effort on the part of the silverware manufacturers to repeal the Silver Purchase Act. The trend of increasing consumption of silver—without considering the expected use of the white metal in the defense program—coupled with declining world production and the broadening influence of the Bank of Mexico's policies on the market indicate that silver prices will remain at the high levels recently attained, or may even go higher. The fabricators of silver recognize that the way to counter this development is to repeal the purchase provisions of the Silver Purchase Act so that domestically-mined silver presently going into Treasury stocks will have to seek a market in New York. If such an eventuality should transpire, silver brokers and fabricators would clap their hands in glee at the resulting downward pressure exerted on the silver price.

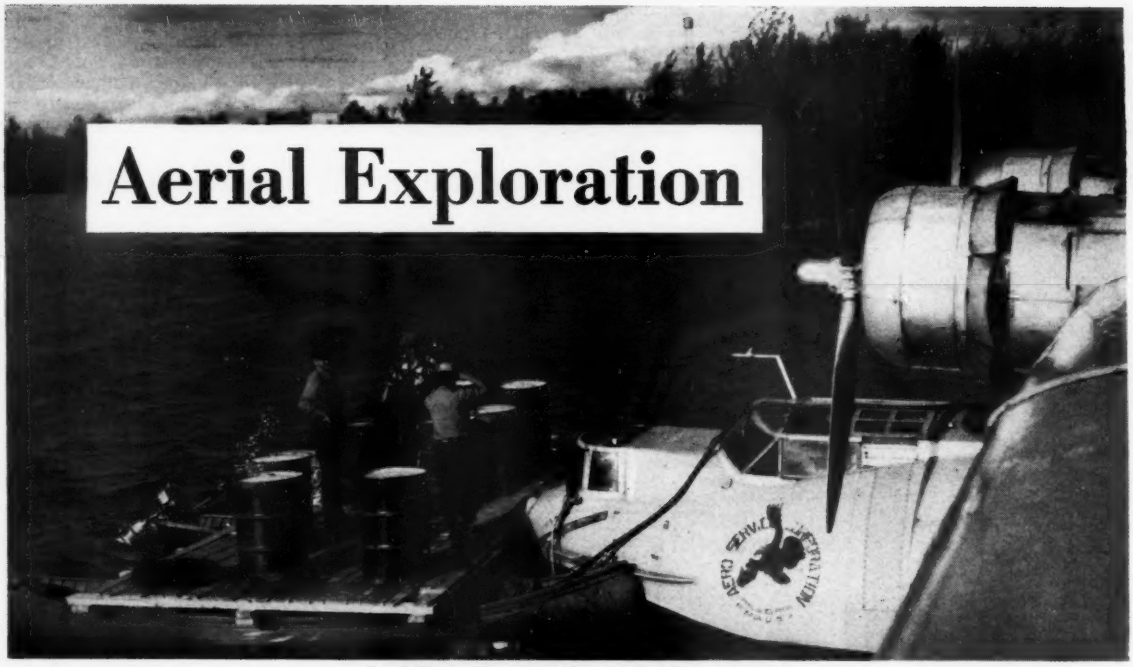
Recent articles in *Harper's* magazine (May 1950) and *The American Magazine* (June 1950) which blasted the use of silver as money are part of a campaign to engender popular support for the repeal of existing silver purchase statutes. It now appears that silver miners must combat fire from two sides: (1) Silver manufacturers and (2) misguided economists. The support offered by Senator Douglas and the January Report of his Subcommittee on Monetary Credit and Fiscal Policies to the cause of the silver users should not be reckoned with lightly. This double-barrelled attack upon the welfare of the Western silver miners is likely to be resumed in the 82nd Congress.

Unfortunately, the one-track minds of silver fabricators have not been receptive to one vital fact: The prestige which silver has gained as money throughout the centuries has formed the basic foundation for the demand for sterling silverware and related products. Silver users do not seem to realize that it is in their own best interests that they pay a higher price for silver. Instead of deprecating the silver policy of the United States, the users of silver should logically join with the producers in a program to enhance the position of silver in our monetary system, as well as in its many other essential uses, for such activity will contribute materially more to the long-run well-being of the fabricating industry than the present course upon which the manufacturers have set sail.



* *Journal of Commerce*, New York, Nov. 9, 1950.

Aerial Exploration



Amphibian planes are often used in remote areas

Airborne Magnetometer Extends Mineral Reserves

By HOMER JENSEN
Chief Magnetometer Division
Aero Service Corp.

OLDEST of geophysical tools, the magnetometer took to the air and became one of the most important new aids to exploration of this generation. In each of the past four years this instrument has been used to survey areas greater than those covered by geophysicists using all other methods. Over one percent of the earth's land surface has now been surveyed by this aerial method.

Reference to the combination of qualities found in the modern airborne magnetometer indicate the reason for its intensive use during the last four years. It is sensitive, reliable, fast, economical and conclusive. It possesses all these qualities strongly in comparison with other geophysical methods as well as older magnetic methods.

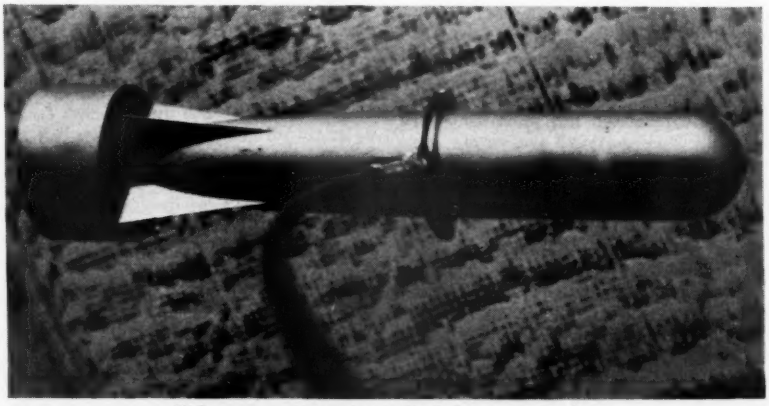
Advantages

Its sensitivity is attested by the recent completion of a magnetic map with a contour interval of one gamma. Probably no magnetic map of this resolution has ever before been prepared, but it is an honest map and a repeatable one. Seldom is such precision required but ability to produce such maps opens new fields for exploration never thought of as magnetic. More usual intervals are the five and ten gamma contours, which also represent high levels of accuracy.

Reliability of operations and positiveness of records is proven by recent history which includes: 60 consecutive days of flight operation; 10,000 linear miles of traverse per month; used from the arctic to the tropics. Surveys are continuous without gaps, subject to complete analysis. Rapidity negates the effect of daily magnetic variations, and control methods reduce remaining effects to near zero. The newest instruments are drift free and their speed of response is so great that no significant variation of the magnetic field is missed.

Only the most sketchy ground survey in the most favorable country can compete in cost with the airborne magnetometer. The range of costs from $7.00-$25.00 per linear mile of traverse is affected very little by location or terrain. It costs little more to survey in the muskeg of the Peace River than it does to survey in mid-continental United States. Ground methods, on the other hand, soar to two, five, and ten times as much. The cost range of ground surveys might be in the ratio of hundreds.

Conclusiveness is perhaps the most



Airborne magnetometer trails below survey plane

important aspect of this method. The whole answer is achieved in one operation, without gaps, even in the toughest country, and there are no second guesses. A well-made map is repeatable in the finest detail. In some cases a survey will prove that in a given area there are just certain ore bodies and no others.

Limitations

Of course, these advantages are not without limitations. The most obvious of these lies in the generalization of information as the result of altitude. Objects separated by distance less than the altitude of the plane do not give separate magnetic signals. This is definitely a limiting factor. As a result, 500 ft has been the average altitude on some 200,000 miles of flying. In extremely rough terrain the demand on the ability of an airplane to go up and down is too great. In mountainous country therefore the quality of the record suffers. A helicopter is well adapted to such terrain and the instrument can be carried in it as easily as in an airplane.

This generalization of the magnetic signal does have some compensating factors. It enables the airborne magnetometer to discriminate between large ore bodies and misleading evidence from surface outcrops. For instance, an outcroping lying directly below a ground magnetometer will give high and erratic values, while an offset mass of a large buried ore body will give a lesser effect. An intuitive examination of the ground magnetic record would then give an erroneous concept of the shape and size of the ore body. On the other hand, the peak of the airborne record will be less affected by the outcrop and more by the massive body, and hence the aerial record will give a curve more indicative of the actual situation.

Special Applications

There are certain geologic problems to which the airborne magnetometer may be most economically applied. Among these are: Cases where ore sought is magnetic. For example, magnetite and ilmenite. Nearly all placer deposits will have resulted in segregation of magnetite along with minerals being sought. Hence, rutile, uranium, gold and tin offer exploration targets in the placer category.

Magnetite produced along with asbestos mineralization has made search for the asbestos possible by this means. Where host rock is highly magnetic and mineralized areas are non-magnetic, traces of the beds are well indicated on magnetic maps and can be traced even though overlain by hundreds of feet of overburden.

Ability to make maps of great precision permits the use of the airborne magnetometer in general structural problems. A one-gamma map will show up dykes and intrusions, however small. Faults and folding will become quite obvious in the magnetic record. Since structure is strongly related to mineralization, the mapping of structure should lead to ore. The ability to map structures across buried valleys should lead to discoveries in areas now beyond exploration.

Changes which occur with the process of metamorphism usually result in an increase of magnetite content. Thus ore bodies associated with basic intrusions would show up as magnetic highs. On the other hand, hydrothermal action reduces magnetite content. A magnetic low, therefore, will be found in association with such mineralized areas.

In the recent past the airborne magnetometer has been used in finding additional ore reserves. Enumerated here are certain cases, based on actual experience, some of which may not yet be identified.

(1) Extension of Ore Bodies.

Airborne magnetometer contours have made possible the extension of bodies beneath lakes or overburden when doubt existed as to whether further outcrops were separate bodies or extensions of known ore. Certain ilmenite and asbestos deposits have been extended in this way.

(2) Extension of Prospective Areas.

In northern Michigan great tonnages of hematite are known to exist beneath the overburden, but drilling to find them can be very expensive. Probable zones have been extended by referring to associated magnetic beds through much of the area.

(3) Finding of New Exploratory Domains.

New iron ranges in Minnesota have been found principally through the use of the airborne magnetometer and extensive magnetic maps can be used elsewhere to detect ore obscured by overburden.

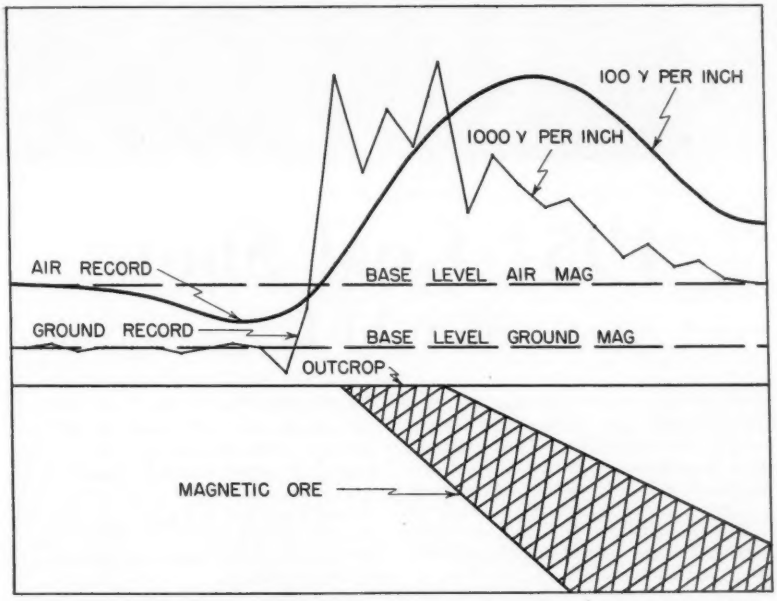
(4) Conclusive Examination of a Geologically Favorable Area.

At Mingan in Quebec contact establishing the boundaries of the anorthosite was first established by widely-spaced magnetic flights. Then within the established boundaries, a precise and closely-spaced survey was made to locate all possible ilmenite deposits. No other exploratory method would have given such conclusive results within a reasonable length of time.

(5) Regional Reconnaissance.

Precise reconnaissance surveys over totally unknown areas can establish broad general trends, indicate the thickness of sediment, and outline major intrusives.

In the four years of its commercial application on five continents and over areas totaling more than 5,000,000 sq miles, much of this work was in the search for oil and positive results must await the normal sequence of petroleum exploration methods. The rest has been in mineral exploration and successes achieved have been outstanding. A responsible geologist has stated that all of the millions spent in experimentation before and during the war for military purposes and since the war in exploration have been paid for many times over by the success already achieved. These are but the first of many such finds.



Air record shows main orebody location rather than outcrop

1951 Coal Show
May 14-17

SHIFTING into high gear to meet any demands the future may bring, the coal industry is formulating plans for emergency production. Men from every coal producing region and manufacturers of all types of mining equipment will meet at the American Mining Congress Coal Convention and Exposition in Cleveland, May 14-17, in a great cooperative effort to coordinate these plans and determine how men and machines may be combined best. This has been the basic thought of the Program Committee in selecting subjects and speakers.

Study of the preliminary program on the opposite page will show that the schedule is practically completed and that procedures, so successful in previous years, are to be followed again. The two general sessions, one each on Monday and Thursday, deal with matters of major interest to coal and national defense, industrial mobilization, public relations and research for greater coal utilization. The other sessions are more specialized and deal with operations of extreme importance to each section of the industry—bituminous and anthracite, strip and deep mining.

To cite any one session or topic as more important than the others would be an injustice. They all cover integral links in the chain of operations from coal face to consumer. Continuous mining and roof bolting, now take equal place with other phases of mechanized mining.

A special round-table conference will be held on Wednesday morning for purchasing agents and others whose responsibilities deal with the knotty problems of materials procurement under increasing Government controls. At the annual meeting of the Manufacturers Division, on Tuesday afternoon, consideration will also be given this subject.

Greatest Exposition Ever

Exhibits of latest machines and equipment in Cleveland's Public Auditorium will provide the background for discussions of individual problems between operating men and manufacturers. Here will be sown seeds of ideas bound to bear fruit in increased output, efficiency and safety.

More than 200 exhibitors are now completing plans for the displays that will crowd all five exhibit halls previously used plus the huge arena with the greatest galaxy of aids to the safe, economical production of coal ever gathered in one place.

Top Flight Entertainment

In view of the large attendance expected and the absence of banquet facilities for so many, it has been decided to forego the annual dinner. Instead, for the evening of Wednesday, May 16 Fred Waring and his famous Pennsylvanians, top attraction of the entertainment world, have been engaged. It is particularly fitting that Mr. Waring is to present his troupe at the Coal Show, since he is a native of the anthracite fields of Pennsylvania.

There will be no other entertainment functions or evening meetings, leaving plenty of time for informal get-togethers after the serious business of each day is finished.

Housing and Registration

As mentioned in previous releases, the streamlined method of registration adopted at the 1949 Coal Show will again be used. An opportunity to register well in advance of the meeting will be accorded to all mining men and manufacturers. Full details, with registration blanks, will accompany subsequent publicity releases.

All reservations for housing are being handled as quickly as possible by the Cleveland Housing Bureau, 511 Terminal Tower, Cleveland 13. Since a capacity crowd is expected, requests for reservations should be sent in without delay.

Preliminary Program

MONDAY, MAY 14

Morning

Open for registration and inspection of exhibits

2:00 pm—Opening Session

Coal and National Defense
To be Announced

Public Relations in the Anthracite Industry
F. W. EARNEST, JR., Anthracite Institute

Public Relations in Bituminous Fields—
Company Magazines and TV Broadcasts
GEORGE VAN HAGEN, Peabody Coal Co.

Mining Community Activities
J. E. ELKIN, Duquesne Light Co.

TUESDAY, MAY 15

10:00 am—Coal Preparation Session

A Panel Discussion on Problems and Solutions
Wet Cleaning Fine Coal
BYRON BIRD, Jeffrey Manufacturing Co.

Current Practices in Air Cleaning
W. C. MCCULLOCH, Roberts & Schaefer Co.

Recent Developments in Coarse Coal Cleaning
DAVID R. MITCHELL, Penn State College

Cleaning Small Sizes of Anthracite
JAMES HANNIGAN, Glen Alden Coal Co.

Related Problems of Mechanical Coal Cleaning
F. P. CALHOUN, Rochester & Pittsburgh Coal Co.

10:00 am—Maintenance and Power Session

Planning for Preventive Maintenance
W. E. WOLFE, National Electric Coil Co.

Underground Maintenance Organization
WM. MACGREGOR, Bell & Zoller Coal & Mng. Co.

Lubrication of Mining Equipment
V. O. MURRAY, Union Pacific Coal Co.

Automatic Centralized Lubrication
L. W. DEUTSCH, Trabon Engineering Corp.
J. B. ANDERSON, The Texas Co.

A-C and D-C Operation—Comparative Costs
J. Z. LINSENMEYER, Westinghouse Electric Corp.

2:15 pm—Roof Support Session

Roof Bolting with Large Mobile Equipment
JOHN K. BERRY, Consolidation Coal Co. (Ky.)

Roof Bolting in Thin Seams with Portable Equipment
C. E. HOUGH, Imperial Smokeless Coal Co.

Geological Considerations in Roof Bolting
PAUL H. PRICE AND A. T. CROSS, West Virginia Geological Survey

Roof Bolting with Dust Control Equipment
JAMES WESTFIELD, U. S. Bureau of Mines

Combined Coal Drill and Timber Setting Machine
CLARENCE M. HAYS, Pittsburgh Coal Co.

2:15 pm—Strip Mining Session

Compressed Air Vertical Drilling
W. J. CRAWFORD, Enos Coal Mining Co.

Selective Elevation Horizontal Drilling
DONALD B. SAXTON, Hanna Coal Co.

Other Late Developments in Overburden Drilling
GENE H. UTTERBACK, United Electric Coal Cos.

Drilling and Blasting in Two-Seam Stripping
RUSSELL BADGETT, JR., Badgett Mine Stripping Corp.

2:15 pm—Manufacturers Division Meeting

Including Discussion of Materials Procurement Problems

WEDNESDAY, MAY 16

10:00 am—Mechanical Mining Session

Mechanical Loading with Extensible Conveyors
A. B. CRICHTON, JR., Johnstown Coal & Coke Co.

Trackless Mining in 30-Inch Coal
IRVIN C. SPOTTE, Princess Elkhorn Coal Co.

Main Entry Development in Low Coal
W. D. HAWLEY, Eastern Gas & Fuel Associates

Mechanical Mining in Anthracite
E. F. YOUNG, Philadelphia & Reading C. & I. Co.
W. I. STONEBRAKER, Hudson Coal Co.

10:00 am—Safety Session

Protection Against Electrical Hazards in Coal Mining
GEORGE C. BARNES, Virginia Polytechnic Institute

Pulmonary Diseases as Related to Coal Mining
DR. A. J. VORWALD, Trudeau Foundation

Advances in Illumination for Coal Mines
G. F. PRIDEAUX, General Electric Co.

Permissibility of Diesel Locomotives for Coal Mining
J. H. EAST, JR., U. S. Bureau of Mines

10:00 am—Purchasing Agents Round Table

2:15 pm—Continuous Mining Session

A Symposium Covering Machines and Operating Methods
GERALD VON STROH, Bituminous Coal Research
A. LEE BARRETT, Joy Mfg. Co.
M. F. CUNNINGHAM, Goodman Mfg. Co.
E. M. ARENTZEN, Lee-Norse Co.
W. J. PHILLIPS, Sunnyhill Coal Co.

Coordinating the Auxiliary Operations
H. B. WICKEY, Pennsylvania Coal and Coke Corp.

Slope Driving with a Continuous Machine
H. A. TREADWELL, C. W. and F. Coal Co.

2:15 pm—Strip Mining Session

Large Augers for Highwall Mining
CHARLES COMPTON, Grafton Coal Co.
D. M. BONDURANT, West Virginia University

Torque Converters in Strip Mine Haulage Units
R. M. SCHAEFFER, General Motors Corp.

Stripped Land Use Developments
(Coal and Other Mining Industries)

THURSDAY, MAY 17

10:00 am—Coal Utilization Session

Problems of Industrial Mobilization
To be announced

Research for Future Uses of Coal
DR. A. A. POTTER, Bituminous Coal Research

New Developments in Coal Burning Locomotives
GEORGE D. CREELMAN, M. A. Hanna Co.

Cyclone Furnace Develops High Combustion Efficiency
MERLE NEWKIRK, Dow Chemical Co.

Afternoon

Open for final inspection and study of exhibits

Wheels of GOVERNMENT

AMC

As Viewed by A. W. DICKINSON of the American Mining Congress

THE 82nd Congress has organized rapidly and swung into action on a number of Administration-sponsored bills. Heading the Senate are Majority Leader Ernest W. McFarland (Dem., Ariz.) and Majority Whip Lyndon B. Johnson (Dem., Tex.), with Kenneth Wherry (Rep., Nebr.) continuing as Minority Leader. House leaders remain as in the previous Congress, with Sam Rayburn (Dem., Tex.) Speaker, John McCormack (Dem., Mass.) Majority Leader, and Joe W. Martin (Rep., Mass.) Minority Leader.

The addition of J. Allen Frear, Jr. (Dem., Del.) to the 13-man Senate Finance Committee gives the tiny State of Delaware two members on this important body. New faces on the powerful House Committee on Ways and Means include Burr P. Harrison (Dem., Va.), Walter K. Granger (Dem., Utah), and Eugene J. Keogh (Dem., N. Y.)

The President's State of the Union message of January 8 set forth a ten-point program including: (1) heavy appropriations for the military; (2) extension and revision of the Selective Service Act; (3) military and economic aid for the "free world;" (4) revision and extension of the authority to expand production and to stabilize prices, wages and rents; (5) improvement of agricultural laws; (6) "improvement of our labor laws to help provide stable labor-management relations and to make sure that we have steady production in this emergency;" (7) full use of all manpower resources, and housing and training of defense workers; (8) means for increasing the supply of medical personnel for the defense effort; (9) aid to the States for elementary and secondary education; and (10) a major increase in taxes.

Taxation

The budget message sent to the Congress on January 15 called for $71.6 billions for the fiscal year beginning July 1, 1951, plus $22.8 billions to be spent at the end of that year. The President forecast a deficit of $16.5 billions to be met through new taxes. He further declared that military demands might raise the new tax figure to as high as $20 billion.

Democratic Senator Byrd of Virginia promptly charged that the budget "represents the very height of fiscal irresponsibility" and declared for a $7 billion cut in non-defense spending. Representative Dan Reed of New York, ranking minority member of the Ways and Means Committee, stated flatly that Congress should not increase taxes until the President's $71.6 billion budget has been cut by $7 billion. Said Reed, "I most certainly reject the contention that we need $16 billion in new taxes. I am not even certain that we need to raise half that amount."

Treasury Secretary John Snyder declared that the Treasury staff is "wasting no time" in preparing the Administration program. Ways and Means Committee Chairman Doughton has announced that hearings on tax legislation will begin February 5.

The President's Economic Message called for increasing taxes "by very much more than they were increased by the last two major tax bills which the Congress enacted." He stated that the new taxes must press harder upon every source of available revenue. An economic report accompanying the message commented adversely on the long-established bases of mineral depletion allowances.

The Tax Committee of the American Mining Congress is meeting immediately to determine a course of action.

Renegotiation

The Renegotiation Act of 1951 is now pending in the Senate Committee on Finance following House passage January 23. The Finance Committee hearings began January 31 and the Committee is expected to make a very thorough investigation of the subject.

As introduced in the House by Ways and Means Committee Chairman Doughton, the bill did not contain an exemption from renegotiation for mineral raw materials such as has been carried in the law since 1942. However, as reported by the Committee on Ways and Means to the House, and as passed by the House, the bill contains mandatory exemptions for the products of metals, coal and nonmetallic mineral mines. This was in response to strong recommendations made by the American Mining Congress and the Defense Minerals Administration. Based upon these recommendations the Committee first voted into the bill the raw material exemption of the old law, providing that: "The provisions of this Act shall not apply to any contract or subcontract for the product of a mine, oil or gas well, or other mineral or natural deposit, or timber, which has not been processed, refined, or treated beyond the first form or state suitable for industrial use."

Later in the day, at the urging of

★ ★ ★ ★ ★ ★ ★

Washington Highlights

CONGRESS: Organized and working.

TAX: Administration demands staggering.

RENEGOTIATION: House fumbles metals exemption.

TRADE AGREEMENTS: Three-year extension demanded.

FREIGHT RATES: ICC considers increase.

MANPOWER: Deferment of miner reservists.

COAL: $1.60 pay increase.

DEFENSE: Administration streamlined.

★ ★ ★ ★ ★ ★ ★

representatives of Government departments in executive session, the Committee reconsidered its vote and placed in the bill language under which the renegotiation of contracts or subcontracts is extended down to the mill or ore-bin at the mine. It is understood that the simple exemption of existing law, under which renegotiation was not extended below the ingot, bar, slab or pigment stage, was acceptable to the representatives of the Armed Services present in the Committee room. The simple form of amendment is important not only to the producers of metals but also to the producers of ores, whose net returns are tied directly to the standard market prices of metals under long-established smelting contracts and customs. The new language would also upset the established regulations and practices of the Renegotiation Board as well as various accounting practices and relations throughout the mining industry.

Trade Agreements

The Committee on Ways and Means began hearings January 22 on the Administration's bill to extend the President's authority to negotiate foreign trade agreements for an additional three years beyond June 12, 1951. Secretary of State Acheson and other Administration stalwarts have appeared in support of the extension, and a full calendar of opposition witnesses is being heard by the Committee.

Minority Committee members are expected to try to amend the bill to include the "peril point" provisions of the Act passed by the 80th Congress, which required the President to explain to Congress any proposed cut in duty made in the face of the U. S. Tariff Commission's finding that it would seriously harm a domestic industry. An effort is also expected to amend the measure to include "escape clauses" in existing trade agreements which do not now contain such clauses, and to limit extension of the Trade Agreements Authority to two years instead of three.

When the bill reaches the Senate Committee on Finance, Senator Millikin (Rep., Colo.) will make a determined effort in behalf of the "peril point" provision and he has stated that "there is every chance we will win."

Meanwhile, bills have been introduced by Patterson (Rep., Conn.) and Mills (Dem., Ark.) in the House and McMahon and Benton (Dems., Conn.) in the Senate to suspend the two cents a pound import duty on copper.

Also introduced in the House by Jenkins (Rep., Ohio) is a bill calling for an increase in the import tax on crude petroleum to 2 cents per gallon.

Freight Rates

The railroads on January 16 filed petition with the Interstate Commerce Commission for a new general 6 percent increase in freight rates. On coal, the petition calls for an increase of 18 cents a net ton. The carriers followed on January 19 with a petition for authority to put the proposed increases into effect on an interim basis, pending the ICC decision on the permanent increase. Since 1946 the Commission has thus far granted increases of approximately 57 percent.

On delivered pricing, Senator Pat McCarran of Nevada has called for legislation to permit freight absorption. McCarran cited the recent ruling of the Supreme Court that a company charged with unlawful price discrimination may justify its prices if it can prove they were necessary to meet competition. He declared this ruling bore out the intent of the freight absorption bill approved by Congress last year, but vetoed by the President. Said McCarran, "Congress can now act without fear of coercing the court because the court has handed down the decision for which we were told we would have to wait. If Congress now acts to confirm this decision, uncertainty will be ended."

Manpower

Underground metal miners have been added to the list of critical occupations used by the Department of Defense as a guide to granting deferments in calling reservists and National Guardsmen to active military service. This action was taken through the Department of Labor, which has stated that metal miners now covered by the list perform a significant combination of duties involved in underground mining.

The Department of Defense has advised the Defense Minerals Administration and the American Mining Congress of a revision of procedures to be followed in recalling reservists and National Guardsmen to military service, where such individuals are in critical occupations or hold key positions in the mining or mining equipment manufacturing industries. This revision calls for coal, metal and nonmetallic mineral mining companies and for mining equipment manufacturers to take the following steps:

(1) Prepare lists of their personnel in key positions or critical occupations who are members of reserve components or of the National Guard, setting forth for each man his name, rank, serial number, location, present position, length of deferment recommended, and justification for delaying recall to active service. In compiling these lists, a separate listing should be made for each military service, i.e., Army, Navy, Air Force, Marine Corps.

(2) Transmit a copy of these lists

(*Continued on page* 124)

I'VE ALWAYS HAD A FEELING I'D LIKE TO GET INTO SOME OTHER LINE OF WORK, BUT THE MORE I READ ABOUT ATOMIC BOMBS, THE BETTER I LIKE IT HERE DOWN IN THESE MINES.
McNaught Syndicate, Inc.

The Washington Evening Star

Appointment of **Arthur C. Bigley**, general superintendent of mines for the Anaconda Copper Mining Co. in Butte, Mont., to manager of mines, and **Edward J. Renouard, Jr.**, assistant general superintendent of mines, as his successor, was announced January 2 in Butte by Edward S. McGlone, vice-president in charge of western operations for the company.

Mr. Bigley succeeds **H. J. Rahilly**, who will report to the mining department of the company in New York. **T. Charles Wise**, superintendent of the Mountain Con mine, becomes assistant general superintendent of mines in Mr. Renouard's place, and **Victor O'Leary**, mine foreman at the Mountain Con mine, succeeds Wise.

George P. Wilson, Jr., manager of the control section, engineering and construction division of Koppers Co., Inc., was named director of the coke division of the Defense Solid Fuels Administration. He was appointed to the position by Secretary of the Interior Oscar Chapman and has been granted a leave of absence by Koppers.

Thomas F. Edson, superintendent of operations at the Silver Bow, Mont., plant of the Victor Chemical Co., has been advanced to executive vice-president of the company at its headquarters in Chicago. In 14 years he has advanced from plant engineer at the company's subsidiary plant of the Maas company in Los Angeles to vice-president. He has been succeeded as superintendent of Montana operations by **Clarence G. Derick. William Anderson, Jr.**, is in charge of the Victor company's phosphate mining operations at Maiden Rock, Mont.

T. E. Williams succeeded **W. L. Davis** as superintendent of the South Wilkes-Barre No. 5 mine of the Glenn Alden Coal Co. Davis has retired from his post after 48 years with the company, 20 of which were spent as superintendent of the South Wilkes-Barre colliery. Williams, mine foreman for the last few years, is succeeded by **W. G. Young**, formerly section foreman.

W. C. Page, vice-president and general manager of western operations, United States Smelting Refining & Mining Co., was named president of the Utah Mining Association at a meeting of the association board of directors early in January. He succeeds Paul H. Hunt, vice-president and general manager, Park Utah Consolidated Mines Co. R. D. Bradford, general manager of the western department, AS&R, was elected second vice-president, and Cecil Fitch, Jr., was elected third vice-president. He is vice-president and general manager, Chief Consolidated Mining Co. Elected to the board of directors at a meeting of the members were James J. Lillie, geological engineer, International Smelting & Refining Co., and W. G. Rouillard, superintendent of AS&R's Garfield smelter, and Ernest F. Goodner, manager, American Gilsonite Co. A. G. MacKenzie, a former manager of the association, was elected to the first vice-presidency.

Charles E. Walker, general manager of Island Creek properties, has been transferred to Pond Creek Pocahontas to fulfill similar duties there. Walker's successor at Island Creek is **Hubert H. Barber** formerly manager of the Bartley Division of the Pond Creek Pocahontas Co. Former division superintendent at Island Creek, **Nicholas T. Camicia** moves into the position vacated by Barber. These changes recently announced by **James L. Hamilton**, vice-president in charge of operations, Island Creek Coal Co., were necessitated by the expansion of Pond Creek's West Virginia and Kentucky divisions.

Other changes also announced include the transfer of **William F. Diamond** from Marianna Smokeless Coal Co. to Kentucky Elkhorn Division of Pond Creek as manager to replace recently resigned **W. A. Haslam. David E. Bayer**, assistant manager, Bartley Division, replaces Diamond as manager of Marianna.

C. L. Holcomb has been appointed general plant foreman of the new washing plant being built by Oliver Iron Mining Co. at the Gross-Marble mine, Mich.

J. B. Morrow, chairman of the board, Pittsburgh Coal Co., and vice-president, Pittsburgh Consolidation Coal Co., will be awarded the Erskine Ramsay Medal for distinguished service to the coal industry, as an executive in trying times and especially for his contributions to the theory and practice of coal beneficiation. The citation to Mr. Morrow also makes reference to his early recognition of the need for coordination between interests of consumers and producers of coal; the technical papers he has written and his inspiring example to younger engineers.

The award will be presented to him at the annual meeting of the AIME in St. Louis, Mo., this month.

James Douglas was appointed acting deputy administrator of the Defense Minerals Administration by Secretary of the Interior Oscar L. Chapman. He will assist DMA administrator James Boyd in the supervision of programs designed to assure an adequate supply of critical and strategic metals and nonmetallic minerals to support national defense effort and the national economy.

J. W. Bryant has been named controller of Reserve Mining Co., according to a recent announcement by C. L. Kingsbury, vice-president and treasurer of the company which is jointly owned by Armco Steel Corp. and Republic Steel Corp.

C. L. Mabrey has been promoted to the post of safety inspector at the Carswell Mine, Carswell, W. Va., of Eastern Gas and Fuel Associates.

Carlton H. Rose has been named manager of the Washington, D. C., office of National Lead Co.

Ray Thompson has been elected president of the Garland Coal Co., Knoxville, Tenn., according to a recent announcement from that company.

Howard Lee Young has been appointed assistant manager of sales of the American Zinc Sales Co., succeeding the late Frederick W. Knoke. Mr. Young has been connected with the sales department of the company since 1937, at which time he joined the pigment sales division at Columbus, Ohio. He became central district sales manager in 1946 and has since served in that capacity, handling the sales of slab zinc, zinc oxide, and by-products in the central district.

—Obituaries—

W. W. Walker was named president and treasurer, **A. R. Black** and **W. G. Stephenson** vice-presidents and **James R. Gilliam** secretary when the board of directors of the Sovereign Pocahontas Coal Co. met recently in Bluefield, W. Va.

Pickands Mather & Co. has announced the admission of two new partners, **Elmer C. Brunner** and **Henri P. Junod.** Both men are veterans in the organization, Mr. Brunner having 34 years' service and Mr. Junod 27 years.

John D. Cooner, Sr., mining engineer from Waverly, Pa., has been named to head the newly created mining branch of the U. S. Bureau of Mines anthracite research laboratory at Schuylkill Haven, Pa.

Appointment of **Thomas K. Graham** as superintendent of the electrolytic zinc plant of Anaconda Copper Mining Co.'s Great Falls reduction works was announced early in January by **R. B. Caples,** manager. Graham has been assistant superintendent since September 1949. He succeeds **E. C. Van Blarcom** who accepted a position with Singmaster and Breyer, consultants in metallurgy, New York. **Guy T. Wever,** formerly superintendent of the indium and rare metals department of the zinc plant, will serve as assistant under Graham.

Charles E. Wilson, director, Office of Defense Mobilization, recently announced the appointment of General **Lucius D. Clay, Sidney J. Weinberg** and **Fred Searls, Jr.** as assistants. General Clay has been granted leave from his post as chairman of the board, Continental Can Co. to take up his new duties. Weinberg is on leave of absence from Goldman Sachs & Co. where he is a partner, and Searls, vice-president of Newmont Mining Co., is on loan to specialize in materials problems.

Alan F. Shelden has been elected president of Kennecott Wire & Cable Co., a subsidiary of Kennecott Copper Corp. He succeeds **Robert L. Coe,** who has retired.

Benjamin F. Fairless, president, U. S. Steel Co., has announced the retirement of **John G. Munson,** who since 1939 has been vice-president-raw materials, U. S. Steel Corp. of Delaware, now merged into U. S. Steel Co. Mr. Munson will serve the company in an advisory capacity for a time. In the organization of the U. S. Steel Co. both engineering and raw materials will be under the direction of **M. W. Reed,** executive vice-president.

Discovery of the Cerro Bolivar iron ore and the development of methods for treating taconite were achievements scored by U. S. Steel during Mr. Munson's term as vice-president.

Richard C. Goss, 52, district manager of the Ohio Brass Co., died of a heart attack on December 29. Mr. Goss joined the company in 1925 and for several years handled the sales of power utilities materials in an eastern territory. In 1932 he was appointed district manager of the mining division.

Arthur W. Dale, 53, general manager of sales of the mining division of Gardner-Denver Co., died suddenly on December 18. Mr. Dale, associated with the company since 1916, first worked in the Denver plant. He was promoted to manager of the Pittsburgh office and for five years was director of South African operations. In 1944 he became manager of mining sales with headquarters in Quincy, Ill.

DR. FRANCIS A. THOMSON

AN APPRECIATION BY
CARL J. TRAUERMAN

Dr. Francis A. Thomson, 71, retired president of the Montana School of Mines and retired director of the Montana Bureau of Mines and Geology, passed away in Spokane on the morning of January 11.

Dr. Thomson was born in London, England, December 21, 1879. In 1886 he came to British Columbia with his parents and made several trips to sea with his father, John Alexander Thomson, who was a prominent seafaring man. Dr. Thomson early chose mining as his life's vocation and, before attending college, gained practical experience in the mining camps of the west. He received his mining engineering degree with the class of 1904 at the Colorado School of Mines and after that, attended the Royal School of Mines in London and the Ecole des Mines at Paris. He received a degree as Master of Science at the Colorado School of Mines in 1914 and in the summer of 1950, the Colorado institution conferred upon him a medal of honor as a distinguished alumnus.

After a few years as dean of the faculty at Washington State College at Pullman, he became dean of the School of Mines at the University of Idaho, at Moscow. In 1928 he was appointed president of the Montana School of Mines, a position which he held until he retired, due to poor health, on September 15, 1950. During his tenure as president at the Montana School of Mines, he also was director of the Montana Bureau of Mines and Geology. Under his direction, both the "School" and the "Bureau" were built up until they ranked at the top among like institutions in this country and abroad. Although deeply devoted to his educational and professional tasks, he aptly symbolized the maxim "If you want a job well done, give it to a busy man," and always managed to find time to perform outstanding civic and humanitarian work for the community in which he lived and in behalf of his friends and neighbors.

In Dr. Thomson's passing the world loses a great man, the educational and mining fields lose an outstanding leader, the commonwealth of Montana loses one of its foremost counselors, and the citizens of his community lose a true friend. He accomplished his life's ambition at a tremendous cost to his health.

At a testimonial dinner honoring Dr. Thomson, at the 1950 convention of the Mining Association of Montana, his fast waning strength was apparent and many of his friends and associates who shook hands with him for the last time realized the sacrifices that Dr. Thomson had made and thought, "Greater love hath no man than this, that he lay down his life for his friends."

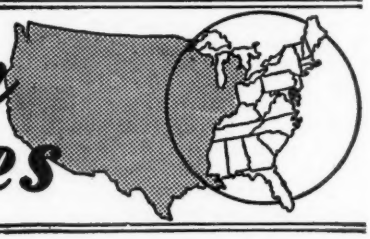
Louis C. Sabin, 83, died on December 30, 1950, at Cleveland, Ohio. Mr. Sabin, one of the foremost authorities on Great Lakes navigation and commerce, was vice-president of the Lake Carriers' Association for more than 20 years before his retirement in 1948.

C. L. Bowman, 67, president and treasurer of the Bowdil Co. died on January 30 in Canton, Ohio. Mr. Bowman started his career at the age of 15. He traveled extensively as a salesman to the mining industry in all parts of the United States, Mexico and Canada. In 1918 he joined his father who was developing the Bowdil cutting bit. In 1923 the Bowdil Co. was formed with Bowman Sr. as president and manager. Upon his father's death, C. L. Bowman succeeded to the presidency and managership, enlarged the facilities greatly and opened a plant in England.

He was a member of the National Association of Manufacturers, the Ohio Association of Manufacturers and was a member of the board of governors of the Manufacturers' Division, American Mining Congress.

NEWS and VIEWS

Eastern States



New W. Va. Strip Mine

Turkey Creek Coal Co. of Jerryville, W. Va., opened a new strip mine late in December to work the Sewell seam in Webster county. Present daily capacity is 400 tons but plans are to increase production to 1000 tpd by July.

Certified "Excellently Managed"

Pittsburgh Consolidation Coal Co., Pittsburgh, Pa., is among 238 firms in United States and Canada to receive certificates of management excellence for 1950 according to J. Martindell, president of the American Institute of Management.

In weighing the merits of each of the 2000 firms studied, credits are given for excellence in ten separate fields; economic function, corporate structure, health of earnings growth, fairness to stockholders, research and development, directorate analysis, fiscal policies, production efficiency, sales vigor and executive evaluation.

More Steel Through Coal Cleaning

Completion of another step in the expansion program of Inland Steel Co. was disclosed recently with the announcement that the company has placed in operation a coal preparation plant at its East Kentucky mines capable of processing 750 tons of raw coal an hour.

Mechanical removal of slate, stone, and other impurities in the new plant will reduce the ash 50 per cent in coke made from the coal, and increase its "fixed" carbon, the essential element for blast furnace use, Philip D. Block, vice-president in charge of raw materials said.

Hjalmar W. Johnson, vice-president in charge of steel making, said the lower ash coke will enable production of 200 tons more pig iron daily with present equipment and that this additional molten iron will speed production of steel by cutting heat time in open hearth furnaces where it is used in the making of steel.

Improve Navigation

Completion of the new lock and dam on the upper Monongahela River near Morgantown, W. Va., by the contracting division of Dravo Corp., has just been announced by the Fittsburgh District, U. S. Army Corps of Engineers.

Colonel Conrad P. Hardy, district engineer, said the project was finished five months ahead of schedule. It was started in September 1948.

Part of the program is to improve navigation on the Monongahela River

Paul Wooton, who was news editor of Mining Congress Journal in 1917, receives the National Business Publications' Silver Quill award from President Truman at the Business Mobilization Dinner of the Society of Business Magazine Editors in Washington. Wooton was accorded this honor in recognition of his more than "thirty years of conspicuous endeavor in behalf of the business press and the public interest."

and permit barge transportation of high-grade metallurgical coal to western Pennsylvania industry. The new lock and dam replaces two old ones.

The lock will accommodate six fully loaded coal barges and a 175-ft towboat in a single locking. In contrast, the old locks could handle only two barges at a time and these could be loaded only to two-thirds of capacity due to the limited draft through the old locks.

The new dam has six 60-ft wide openings allowing control of the river flow by tainter gates. The lock chamber is 84 ft wide and 600 ft long with concrete guide walls extending 600 ft each way.

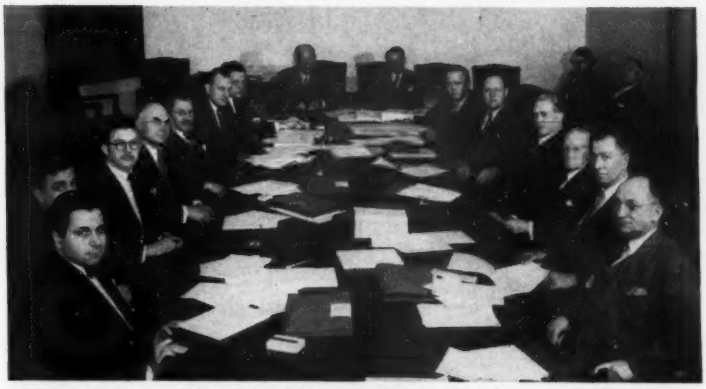
Seventy-fifth Anniversary

Seventy-five years of uninterrupted business relationship between a United States coal producer and a foreign sales agency was attained with the ending of the year 1950.

Hull, Blyth & Co., London, England, had just been organized as a coal sales agency in 1875 when it obtained as a client the then eight-year-old Pocahontas coal producing organization of Castner, Curran & Bullitt, Inc., of Pittsburgh, Pa.

The English company still represents the 83-year-old C. C. & B. organization in the distribution of steamship bunker coal in Europe and other parts of the world, and all types of C. C. & B. coal in the United Kingdom.

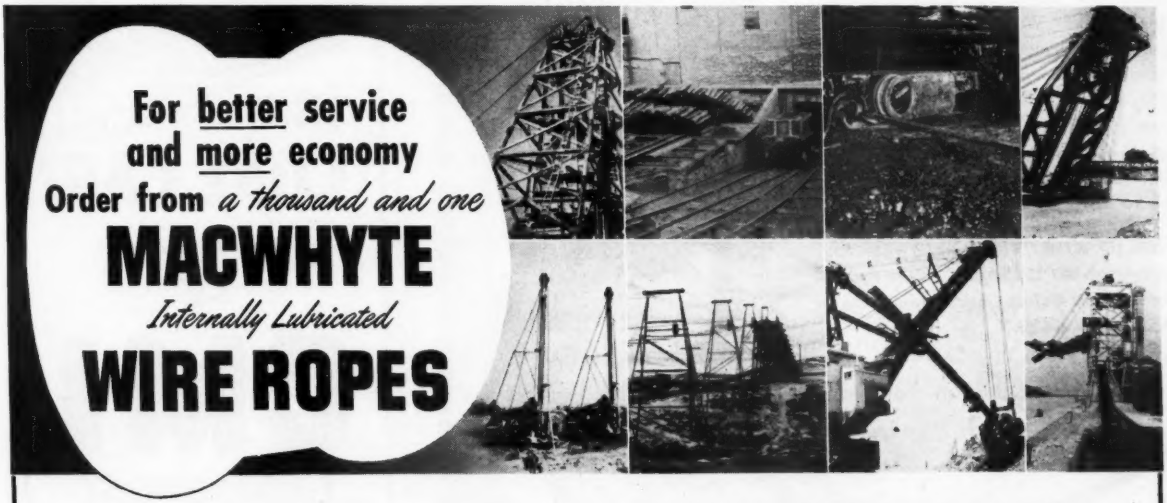
This is believed to be the oldest agency-producer relationship in existence and between one of the oldest coal sales agencies in the world and the oldest coal shipping organization in the United States.



Representatives of 11 leading mineral industry publications met F. H. Hayes, Acting Director, Copper Division and Miscellaneous Metals, and W. W. Hopton, Acting Director, Tin, Lead and Zinc Division, NPA, for an informal discussion on the NPA program and how it affects production in the industry. H. B. McCoy, Assistant Administrator for Industry Operations; Nigel H. Bell, Director, Light Metals Division; David B. Carson, Director, Iron and Steel Division, also addressed the meeting in Washington, D. C., on January 17. This is the first of a proposed series of such meetings designed to promote an exchange of opinions, information and ideas.

Plan Expansion

At Evarts, Ky., the Dartmont Coal Co., which is presently producing 600 tpd, plans to increase production to 1500 tpd beginning May 1951. The company has recently opened the Silver Splint mine in Harlan county on the High Splint seam.



It will pay you to get Macwhyte Wire Rope engineered and job-proved for your equipment. Over the years, ropes for all types of mining equipment have been developed by Macwhyte. Recommendations are promptly available from Macwhyte distributors or Macwhyte Company.

MACWHYTE COMPANY

2952 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope. Catalog available on request.

Mill depots: New York • Pittsburgh • Chicago • Minneapolis • Fort Worth • Portland • Seattle • San Francisco • Los Angeles. Distributors throughout U.S.A.

YOU GET THE CORRECT WIRE ROPE FOR YOUR EQUIPMENT WHEN YOU BUY MACWHYTE

THE EASIEST WAY TO MAKE ENDS MEET

Even on the toughest piping jobs VICTAULIC Couplings, Victaulic Full-Flow Elbows, Tees and other Fittings will make joining those pipe ends quick, easy and economical—assure you a leak-tight piping job!

You save every way when you join up with "Vic"—a simple two-bolt design gives quick, easy hookups, a standard speed or T-Wrench is the only tool needed for connections... joints are positive-locked, leak-proof, will stand up under extreme pressure, vacuum, or strain conditions.

GROOVING THOSE PIPE ENDS is a cinch the Victaulic Way..."Vic-Groover" grooves 'em automatically in half the time of a conventional pipe threader! The COMPLETE Victaulic Line *can't be beat* for efficient, dependable, on-the-job piping construction. Yes Sir! Victaulic IS the Easiest Way to Make Ends Meet.

JOIN UP WITH "VIC"—make your next piping job ALL VICTAULIC. Write today for Victaulic Catalog and Engineering Manual No. 44-8E.

VICTAULIC COMPANY OF AMERICA
30 Rockefeller Plaza, New York 20, N. Y.

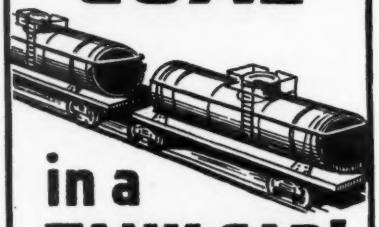
Victaulic Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 406 Hopewell Avenue, Toronto 10, Ontario.
For Export outside U. S. & Canada: PIPECO Couplings & Fittings, Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

27TH VICTAULIC YEAR

The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS

Copyright 1951, by Victaulic Co. of America

You *would'nt* SHIP COAL



in a TANK CAR!

why SHIP WATER

in a COAL CAR?

a

C·M·I *Centrifugal* DRYER

—will turn your slurry and "wet coal" liabilities into assets and... profits.

CENTRIFUGAL & MECHANICAL INDUSTRIES, INC.
146 President St., St. Louis 8, Mo.

To Up Production 25 Percent

Woodward Iron Co., Woodward, Ala., is completely mechanizing its Mulga mine. The program is expected to increase production at least 25 percent. Plans call for the installation of a new slope belt, to replace the present shaft, the use of continuous miners and the introduction of larger mine cars and other auxiliary equipment. During 1950 the mine produced at the rate of 600,000 tons per year.

Purchase Steel Plant Site

National Steel Corp., Pittsburgh, Pa., has purchased a tract of more than 2000 acres located on deep water of the Delaware River in New Jersey about 10 miles south of Camden, it was announced by Ernest T. Weir, chairman.

"The property has been acquired," Mr. Weir said, "for the construction of additional facilities to help meet the demands of National Steel Corp.'s continually growing business. The eastern plant will provide a substantial tonnage of steel products for an expansion of domestic distribution and also for the company's export trade."

He stated that plans are being developed to determine the lines of steel production to which the new plant will be devoted. No date has been set as yet for the start of construction.

National Steel Corp.'s present ingot capacity is 4,500,000 tons per year. A program of expansion now under way at various other National Steel operations will be largely completed early in 1952 and will increase the company's annual ingot capacity to 6,000,000 tons. This total will be further increased by the capacity of the proposed new operation.

The location of the eastern plant will afford transportation advantages for both inbound and outbound materials, since large ships will be able to berth at the plant's docks. Iron ore for the eastern plant's blast furnaces will be transported directly in ocean-going carriers from the new Labrador-Quebec iron ore field, in which National Steel Corp. is heavily interested.

Sizes and accessories for your individual requirements. Write for information and sample.

BEMIS BRO. BAG CO.
111 No. 4th Street, Box 35, St. Louis, Mo.

The Heart...
is as tough as the Hide!

THROW OPEN THE LIDS on this underground brute and you'll find it has a rugged, tireless heart that has kept it on the job day after day, years upon years. Its heart is a durable, dependable EDISON storage battery.

Like the machine they propel, EDISON cells are built of sturdy steel inside and out. They take extreme abuse in stride: many have fallen down shafts or been in fires or floods, and still gone back to work and served a full long life.

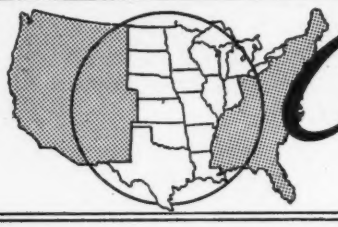
Electrochemically, they have no self-destructive reactions. Their electrolyte even preserves the steel parts. And they can't be injured by accidental short-circuiting or reverse charging . . . or standing idle during shutdowns . . . or even by freezing!

Because they're the best mine haulage batteries that can be made, EDISON batteries cost a little more initially. But they pay this back over and over in terms of tons hauled, years worked and down-time saved.

Write today for latest quotation. Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, New Jersey. In Canada, International Equipment Company, Ltd., Montreal and Toronto.

EDISON

Nickel · Iron · Alkaline
STORAGE BATTERIES



Central States

Reforestation Program to Continue

Financial aid from Indiana Coal Producers and Illinois Coal Strippers Associations will make possible continuation of U. S. Forest service tree planting experiments. These are designed to test the suitability of several tree species for planting on different kinds of spoil banks, and to investigate the management of natural forests and older plantations, growing on stripped coal lands, to assure sustained production and develop better harvesting and marketing methods of the merchantable products they now contain.

Completion of the agreements covering the Forest Service research was announced jointly by R. D. Lane, forester in charge of the Carbondale, Ill., branch of U. S. Forest Service; A. J. Christiansen, secretary-treasurer of the Illinois Coal group and L. E. Sawyer, director of Forestry and Reclamation for the Indiana association. The new agreements will not curtail other research activities sponsored by the organizations.

Beryl from Black Hills

To help speed national defense, U. S. engineers are investigating a low-cost method to mine the beryl ore in the Black Hills to obtain beryllium, needed in atomic energy research and as an alloying element. The pegmatite deposit at the Peerless Mine in Pennington, S. D., 22 miles southwest of Rapid City, is being examined for the mineral.

DMA Office for Joplin

Interior Department has established a Defense Minerals Administration headquarters office for several states in Joplin, Mo. The states are Missouri, Kansas, Oklahoma, Arkansas, Louisiana and Texas. United States Geological Survey's Dr. David Gallagher arrived in Joplin and established an office in the Independent Building in January. Dr. Gallagher and Mr. L. T. McElvenny, from the USBM station at Rolla, will act as a team to examine and act upon applications for government aid. The DMA office in Joplin will make geological and engineering reports on properties applying for federal aid throughout the region. This work will be done on instructions from Washington. Mr. M. H. Berliner, geologist, is to be associated with the USGS-USBM team on this work.

Eureka Mine Closes

In mid-October the Castile Mining Co. closed down the Eureka iron mine due to the exhaustion of commercial iron ore. For 60 years the Eureka, one of the earliest producers on the Gogebic range of Michigan, had been an active source of iron ore. In 1941 the mine entered the rank of producers that had an output of 10,000,000 tons or more.

Early operations were conducted through an inclined shaft but in 1923 a vertical production shaft was begun. This was eventually deepened to the 30th level or about 1700 ft below sea level.

New Research Lab

International Minerals & Chemical Corp. announced plans for the construction of a new central research laboratory to be located in Skokie, Ill., according to Dr. Paul D. V. Manning, vice-president of the corporation in charge of its research division.

The laboratory will be of modern, fireproof construction, having an area of approximately 33,000 sq ft.

Liquid Fuels from Coal

USBM is making studies on five different types of coal for conversion to petroleum products at its experimental plant at Louisiana, Mo. Everything from jet fuels to aviation base stocks are being studied. The five types of coal represent all of our coal fields but exclude the coking coals needed by industry.

Three percent profit on plant costs would add two-two and one-half cents per gallon.

These prices are within range of present gasoline producing costs.

COSTS ESTIMATED AFTER REMOVAL AND SALE OF OTHER BY-PRODUCTS

Type coal	Cost to produce gasoline	Fields represented
Wyoming bituminous	10.1c per gallon	Colo., Wyo., Utah
North Dakota lignite	10.5	N. D. and Mont.
Montana sub-bituminous	8.0	West
Pittsburgh seam bituminous	11.3	Pa., W. Va., western Ky., Ala.
Illinois bituminous	10.2	Ind., Ill., eastern Ky.

Insertion of a 165-ft section at midship will convert the 454-ft "Notre Dame Victory" into a 615-ft iron ore carrier for the Cleveland Cliffs Iron Co. She will be renamed "Cliffs Victory" and will be the first ocean-going steamship adapted to the iron ore trade. Delivery is scheduled for July 1, 1951, at Chicago, Ill.

Research in this laboratory will be carried on by a staff of 75 in connection with the various operations of International Minerals & Chemical Corp., which includes the mining and refining of potash and phosphate, the manufacture of plant foods and elements for animal feed, amino products, and pharmaceuticals.

New Alcoa Plant

Aluminum Co. of America, as part of its effort to make more aluminum for America's defense and civilian needs, will build a new alumina plant near Bauxite, Ark. Construction of the new plant is to begin immediately.

Designed to process low-grade bauxite ore, it will increase by nearly 50 percent the amount of alumina now being produced by the company. Alumina is the refined ore from which basic aluminum is obtained by the smelting process.

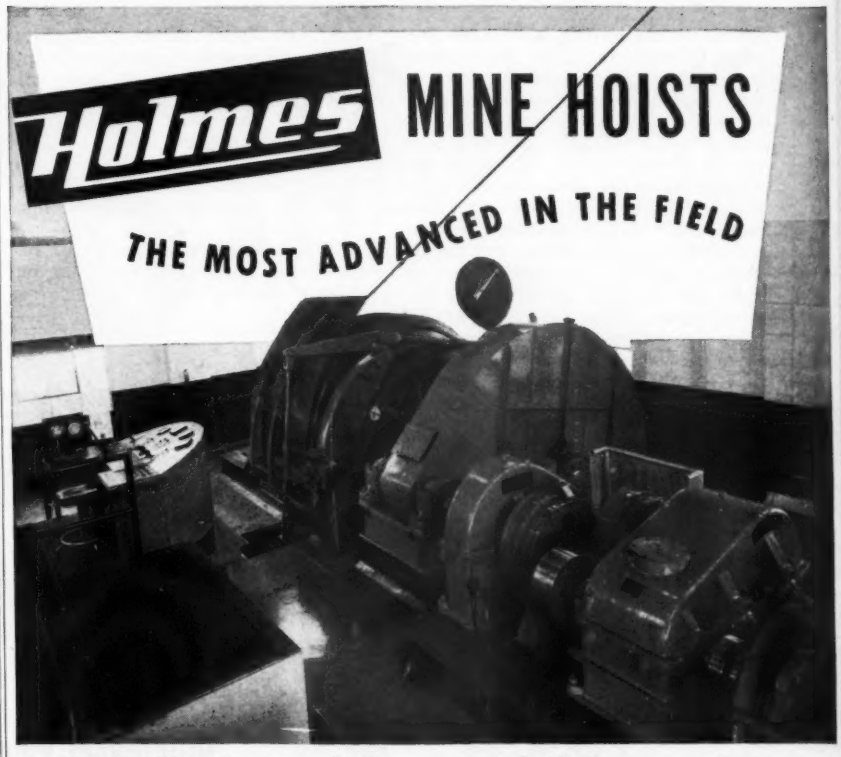
To be operated by Aluminum Ore Co., wholly-owned subsidiary of Alcoa, the new plant will be situated on a 200-acre site adjoining the bauxite mining operations of Alcoa Mining Co., also a wholly-owned subsidiary of Alcoa. Long the largest domestic source of ore for the aluminum industry, the Arkansas area thus assumes added importance in the nation's aluminum producing industry.

Low-grade bauxite will constitute the raw material for this proposed

DAVIS READ
Mining Consultant
Modern Production Methods
Plant Design—Preparation
235 East Noel Ave.
Madisonville, Kentucky

L. E. YOUNG
Consulting Engineer
Mine Mechanization
Mine Management
Oliver Building Pittsburgh, Pa.

J. W. WOOMER & ASSOCIATES
Consulting Mining Engineers
Modern Mining Systems and Designs
Foreign and Domestic Mining Reports
UNION TRUST BLDG.
Pittsburgh, Penna.
NATIONAL BANK BLDG.
Wheeling, W. Va.



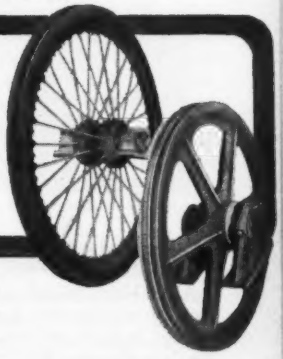
Individually designed for every hoisting requirement

HOLMES' HOISTS, built to withstand years of continuous service, are engineered to include the most advanced developments in hoisting operations. Using only the finest components and metal alloys, Holmes' Hoists are particularly resistant to wear, shut-downs due to mechanical failure, and maintain high production.

Operator's platform and streamlined control console are located for complete visibility of hoist operation, drum position, dial indicator and cage landing. Available with the latest safety controls which act in the event of over-speed, over-wind, power failure or operator's mistakes.

HOLMES SHEAVES

Bicycle and Cast spoke types of lightweight yet strong section to avoid undue bearing wear and high inertia. Plain groove or with renewable steel liners both single and double grooved. From the smallest diameter up to 14 feet. With or without shafts and bearings.



Robt. Holmes and Bros., Inc., with over half a century of mine equipment manufacture, will make a complete engineering survey without obligation. Write, wire or phone.

Dept. C-1.

ROBT. HOLMES & BROS., INC.
DANVILLE, ILLINOIS

plant, its use having been made possible through an Alcoa development achieved early in World War II. At that time, to provide for the greatly increased amounts of alumina required by the war-time aluminum producing plants, the company developed a combination lime soda-Bayer process which for the first time permitted economical use of low-grade bauxite for aluminum production. During the war the process was used at plants built and operated by Alcoa for the government. After World War II, with the disposal of these plants to other producers, Alcoa released to such operators, without any payment or royalty, its patents on the process. The new alumina plant will use this process in its operations.

Operation of the proposed works will involve the employment of approximately 1000 persons. As a result it will be necessary to expand housing facilities to accommodate the new workers and this will be undertaken as required at the present Bauxite town site.

The entire construction project will be carried out by Alcoa, serving as its own general contractor. At the present time, designs for the new plant are practically completed and orders for necessary materials are being placed.

Winter Ore Shipments by Rail

The Oliver Iron Mining Co., a subsidiary of U. S. Steel Co., thawed out an experimental shipment of 135 carloads of iron ore at several of its mills early in January. The ore came from the Monroe open-pit mine near Chisholm, Minn. The rail shipment was made to determine the feasibility of shipping ore by railroad in winter. The method was tested to see whether ore can be shipped all year long. Ordinarily, it is stockpiled until the Lakes are opened for navigation.

In order to keep the ore in movable condition, Oliver installed steaming and thawing equipment capable of loosening ore frozen to the sides and bottoms of cars. The ore is treated with calcium chloride before shipment to keep it from freezing. Since tests proved successful, it is planned to ship up to 400 gondolas from the Mesabi Range daily throughout the winter.

Build Taconite Plant

At Babbitt, Minn., a pilot plant will soon be constructed for the manufacture of taconite pellets. This plant is the first step in a $160,000,000 development program announced by the Reserve Mining Co. of Cleveland, Ohio. The taconite pellet plant will cost about $7,500,000, which will also include cost of construction of the plant, opening a mine and building a new town, two miles north of Babbitt. Permits are now being secured for the project from the state of Minnesota and the federal government for pumping water needed in processing the iron-bearing ore from a near-by lake.

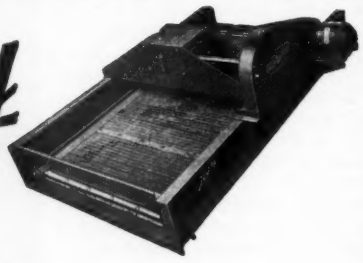
The ore is to be produced by open-pit methods and will test the practicability of changing taconite into high-grade ore.

The company also is considering another pellet plant at Beaver Bay, on the north shore of Lake Superior.

Plan Iron Ore Search

Pickands Mather & Co., acting for a group of steel and iron ore producers, is negotiating with Steep Rock Iron Mines, Ltd. an agreement to explore and an option to lease iron ore property in the Steep Rock Lake area of Ontario, according to Elton Hoyt II, senior partner, Pickands Mather & Co. While details are still to be worked out, plans are to begin exploratory work in the near future.

THE Leahy HEAVY DUTY
NO BLIND VIBRATING SCREEN



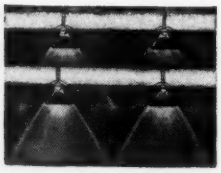
Differential Vibration Produces Screening Efficiency in 90% Range

The screening efficiency of the Leahy No-Blind Vibrating Screen is now a matter of authentic record.

For upwards of 25 years, mine operators have been sending crushed products over Leahy Screens. Those who have kept records say that screenable fines returned to the crushers are practically never over 10% and often as low as 2%.

This efficiency is attributed, largely, to Leahy Differential Vibration that keeps meshes clear at all times, even under long periods of back-breaking production. No other screen offers so much for so little.

For full details ask for Bulletin 14H



CONCENCO SPRAY NOZZLES

These handy nozzles are simple, flexible and economical. All you do is drill your holes, clamp on and get results. They can be definitely aligned for washing, sluicing or spraying, according to need. They are removed or replaced in a moment's time.

THE DEISTER★ CONCENTRATOR COMPANY
CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

917 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

Book Review

MANAGEMENT STRATEGY IN COLLECTIVE BARGAINING NEGOTIATIONS. *By William J. Baade, Jr., Associate Editor, Employe Relations Bulletin, with the assistance of Morris Stone. Published by the National Foremen's Institute, Inc., New London, Conn.* 1950. $2.00. 198 pp.

This interesting book answers many of the questions implicit in the statement "Why unions act as they do." It is pointed out that one cannot do business with unions on a business basis. Modern unions are political, or socio-political, groups whose leaders must formulate their programs and make their policy decisions on the basis of many non-economic factors. Among these factors are the efforts of union officials to maintain their own personal security; the necessity to establish the survival of the union; and an underlying sense of insecurity.

In general, "the collective bargaining agreement is an instrument by which the employer makes many positive guarantees to the union and to his employes while the union gives assurances which are mostly negative in character. . . . The employer who understands the position of the union official in relation to his members will never expect full cooperation against absenteesim or in the enforcement of shop rules." This statement can be regarded as a sample of the realistic approach to the subject of union-management negotiations as treated in this study.

After discussing union-management relations and the law and enumerating unfair practices as employed by either or both sides, this volume goes into detail on employe representation, union elections and educational work among the lower echelons of management. Basic union aims and management strategy in dealing with them are thoroughly covered in another section. The status of "management rights" clauses is discussed and evaluated.

Representatives of management are counselled to approach the bargaining table without fear, prejudice or anger; with a well-planned strategy and full authority to clinch the contract. They are also advised to remember they are not dealing with a business organization but instead one which may behave like a nation: jealous of its boundaries and represented by men who must be mindful of the effect of their actions on their constituents.

This practical guide to successful labor negotiations is realistic in its approach, thorough in its coverage and will be of value to all who deal with unions and employes.

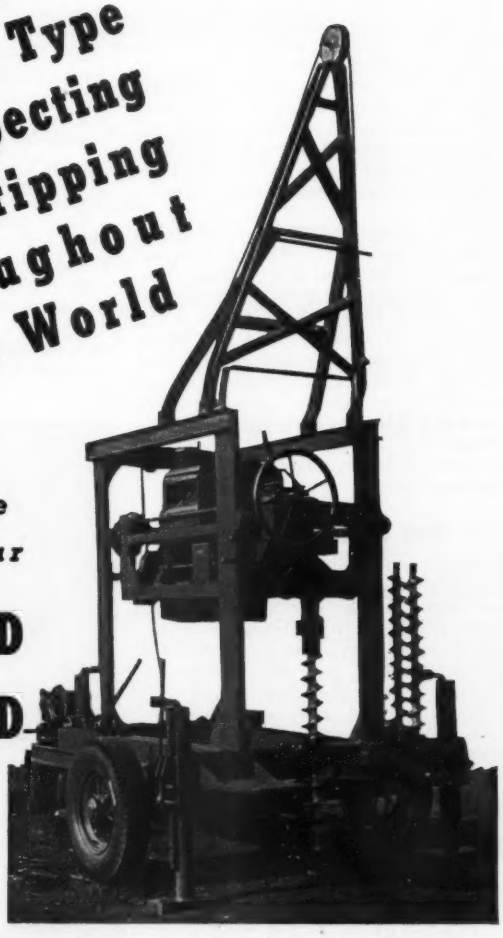
8 YEARS DEVELOPMENT

On Field Tests in Every Type of Prospecting and Stripping Throughout the World

★

Also available in the popular

STANDARD ONE-SPEED DRILL



The Parmanco Two-Speed Transmission Drill is designed to meet the requirements of the general prospecting field where it is not necessary to drill in solid limestone. Special sliding frame permits drilling and pulling of augers without moving drill. New design of chuck eliminates all hand operation in raising power plant. Recommended for 50 to 60 feet with four and one-quarter inch equipment. Under favorable conditions it is being used to greater depths and can be used with six inch equipment.

PARIS MANUFACTURING COMPANY

PARIS, ILLINOIS

Mining Association of Montana Elects

The Ninth Biennial Legislative meeting of the Mining Association of Montana was held in Helena on January 11. Sheldon P. Wimpfen, of the Atomic Energy Commission spoke on uranium mining, and Col. E. K. Cheadle, acting state civil defense director, told how the mining industry can help in civil defense. Gov. John W. Bonner spoke at the joint banquet of the association and the Last Chance Gulch Mining Association. Montana legislators were guests of the associations.

L. B. Manning of Philipsburg, manager of the Trout Mining division, American Machine and Metals, Inc., was elected association president for the coming year. He succeeds O. P. Chisholm of Helena. Ted E. Collins was picked as first vice-president, and Lyman H. Brooks of Cooke City as second vice-president. Carl J. Trauerman of Butte, was reelected secretary-treasurer. Mr. Chisholm becomes a member of the executive committee of the association.

Buys Controlling Interest

Compton I. White, president, White Delf Mining Co. at Clark's Fork, Idaho, announced he has purchased the controlling interest in the Lawrence mine, the Copper Giant, the Clarinda and Larson groups and the Ponderosa property, all in the Clark's Fork district. The White Delf mine has been a large producer of high-grade silver-lead ore. New deep development is under way on the White Delf vein and the upper workings are in production under a lease agreement to Ross Roundy, of Wallace.

Consider Titanium Production

National Lead Co. has leased several buildings at the Henderson, Nev., site of Basic Magnesium Inc. and has contracted for power there with the Colorado River Commission of Nevada.

Production of titanium metal with these facilities is under consideration, but no decision on immediate steps has been reached. A plant capable of turning out large tonnages of the metal would require large expenditures of money and assurance of several hundreds of millions of kilowatt hours of power annually. The lease gives National Lead Co. 80 acres of land with seven buildings totalling almost 200,000 sq ft in area. Power allocations have already been made to the extent of 151,000,000 kw annually.

Titanium metal has qualities of strength, light weight, corrosion resistance, and heat resistance which make it potentially important in military equipment. Production in large volume, however, depends upon creation of a large enough market at a relatively high price.

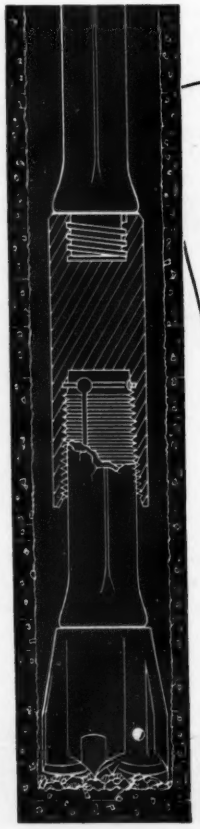
Winter Halts Drilling

Snow has stopped diamond drilling from the surface at the Advance mine property of Mines Management, Inc. east of Northport, Wash., President W. Randolph Green has announced. The crews have been moved to the Iroquois property where they can work underground all winter.

Ancho-Erie Ore Zone Extended

Extensive development of the Erie fissure zone in the Ancho-Erie gold mine has disclosed richer ore than in the Ancho vein, credited with producing about $1,500,000 in ore. The Erie fissure, about 20 ft wide, is being worked south of the Ancho mine and 700 ft below the old Erie workings. An oreshoot about 900 ft long has been developed 400 ft below the old Ancho productive area. The main Ancho vein averages about five ft in width. The Ancho and Erie ledges are 300 ft apart, both dip slightly to the east, and engineers say they may unite at further depth, although this is not certain. Ore is mined in the Ancho workings about 550 ft below the workings which produced large amounts of profitable ore prior to 1915.

Situated in the old Eureka district, 26 miles from Nevada City, Calif., the Ancho-Erie group comprises 30 mining claims. Fred Anderson, Nevada City mining engineer, and associates, negotiated the consolidation of the Erie and Ancho mines shortly before World War II, rehabilitated old workings, drove the Ancho crosscut-tunnel into virgin country and developed a new gold producer. Control of the properties was later acquired by Ancho-Erie Mining Co., dominated by Fleishacker interests of San Francisco.



SAVED!

ONE LOST BIT • ONE DRILLED HOLE
ONE BROKEN STEEL
By ROCK BIT HOLE-SAVER

Used to reclaim lost bits and drill steel broken off in the hole. Request folder. Rock Bit Sales & Service Co., 2514 E. Cumberland St., Philadelphia 25, Pa. *Branch:* 350 Depot St., Asheville, N. C.

Manufacturers of carbide Rok-Bits, Intraset Steel, also a complete line of pneumatic tool accessories.

ROCKBIT
SALES AND SERVICE CO.

Kennecott Aids Research

A grant of $50,000 by the Kennecott Copper Corp. to the Utah State Agricultural College for a five-year research program was made in January. The new grant will continue work started under a similar grant made in 1945. Projects carried on under the Kennecott grants during the last five years have been concerned with an application of mineral products to agriculture.

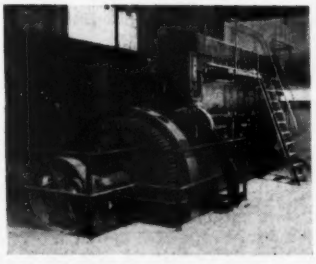
Open Foot-Wall Vein

The Federal Mining & Smelting Co., Mullan, Idaho has opened the Morning foot-wall vein on one of the lower levels. This vein is persistent in the footwall structure of the big Morning vein practically from the surface but is separated from the main vein by waste material. It has been worked by leasers, and produced high-grade ore.

Engineers' Day in April

Colorado School of Mines celebrated its first Engineers' Day in 1927. Since then 16 successful programs have been held. On April 20-21 this year the 17th Engineers' Day will be held. Through the years the day has been managed entirely by the members of the student body. The committee is endeavoring to arrange a program truly representative of the Colorado School of Mines. This year it is promised that every effort will be made to make Engineers' Day bigger and better than ever.

FOR SALE



500 KW Worthington Diesel Generator Set, complete in every respect. 2400 volt. Excellent buy. Includes generator, panel board, starting equip., muffler, intake and cooling equip. Approx. one-third new price. New spare parts available.

Write or wire for full details

ROGER PIERCE EQUIPMENT SALES CO.

808 Newhouse Bldg.
SALT LAKE CITY, UTAH

LOOK TO BRONCO FOR LEADERSHIP

In the future, as in the past, you can look to Western Insulated Wire Co. to develop and manufacture Bronco portable cords and cables that are...

TOUGHER

MORE FLEXIBLE

LONGER LASTING

MORE CONVENIENT TO USE

SOLD NATIONALLY BY ELECTRICAL WHOLESALE DISTRIBUTORS

WESTERN INSULATED WIRE CO.

2425 East 30th Street • Los Angeles 58, California

SPECIALISTS in the design and manufacture of portable electrical cords and cables.

PIONEERS in the manufacture of standardized Neoprene-jacketed cords and cables.

Wheels of Government

(*Continued from page* 111)

to the Defense Minerals Administration with respect to metal and nonmetallic mineral mining and mining equipment manufacturers, and to the Defense Solid Fuels Administration with respect to coal mines. Both of these agencies are located at New Interior Building, Washington 25, D. C. At the same time send a copy of the list to the appropriate military, naval, air force, or Marine Corps headquarters in the area in which the reservists or National Guardsmen are located. This procedure should be followed by metal mines, coal mines, nonmetallic mineral mines, and mining equipment manufacturers.

In the event that a reservist employed in a key position in the mining industry receives orders to report for active duty, an appeal to the appropriate branch of the military service may be made. Such appeals may be made jointly by the employer and the employe, and the employer's statement should indicate in detail reasons why the employe's activation would interfere with the defense effort.

Coal Wage

Effective February 1, 1951, an amendment to the 1950 Bituminous Coal Mine Wage Contract provides an increase of 20 cents an hour in miners' wages. The contract was signed between UMWA and operators' representatives on January 18.

President Harry M. Moses of the Bituminous Coal Operators Association explained that the amendment simply increases the base rate $1.60 a day, approximately 10 percent of the basic average, and creates a termination date fixed as of March 31, 1952, with an open-end clause in the termination date that does not necessarily require that the contract be terminated on March 31, 1952, but can be continued until 60-day notice is given by one side or the other of a desire to terminate.

Defense Production Administration

Early in January the President established a new "Defense Production Administration" to coordinate and direct the defense production program. The DPA is under William Henry Harrison, who with Eric Johnston, new head of the Economic Stabilization Agency, will report directly to Charles E. Wilson, director of the Office of Defense Mobilization. Wilson has announced the appointment of Fred Searls, Jr., president, Newmont Mining Corp., as his assistant to specialize in materials problems.

Wilson explains the new arrangement as largely a matter of internal organization, creating a direct line of authority by DPA over production powers given to regular Government departments. He said that most of these functions, for the time being, will continue to be performed in the departments where they are now being handled; that the Interior Department will continue to administer defense controls pertaining to petroleum, solid fuels, power, minerals and metals, and commercial fisheries. He explained that his Office of Defense Mobilization will determine general policies very much as the Office of War Mobilization did in World War II, and the Defense Production Administration will have about the same powers as did the former War Production Board.

Hillside Mine Active

Ore carrying profitable gold and silver is reported under development at the Hillside mine in the Jackson district, 30 miles west of Austin, Nev. The property was leased last spring by Anthony Selig of Manhattan, and has been a good producer.

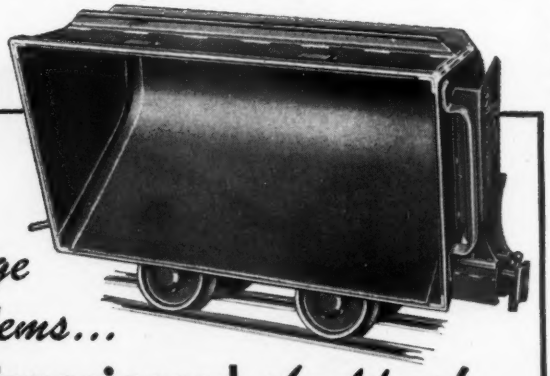
Tungsten in Illinois District

An extensive development program is progressing at a tungsten property of the Gabbs Exploration Co. in the Illinois district about 12 miles north of the Gabbs Valley magnesite site near Mina, Nev. The company installed mining equipment last summer following extensive diamond drilling of a large scheelite deposit. The mine was developed through a series of tunnels a few years ago. Recently drifting and cross-cutting has disclosed a vein of commercial grade scheelite.

Area May Rival Tri-State

Sullivan Mining Co., a subsidiary of Bunker Hill and Hecla, is engaged in a large mining and milling enterprise in the Metaline Falls, Wash. area. The blanket-type zinc-lead mineral zone extends from Stevens county in Washington as far north as Ymir, B. C. This district is said by geologists to rival in extent and tonnage possibilities the famous Tri-State field of Oklahoma, Kansas and Missouri.

The Sullivan Co. took its first major step in this field with the purchase of 700,000 shares of Pend Oreille Mines & Metals Co. stock. This company owned the Pend Oreille mine at Metaline Falls and the undeveloped Reeves MacDonald mine in British Columbia. It is planned to increase the Pend Oreille milling operation to 3000 tons per day. A 2400-ton unit is now in operation. At the Reeves-MacDonald mine a 1000 tons per day milling plant was constructed and has been in operation for some time.



DUMP your haulage problems... on Experienced shoulders!

CARD CARS are engineered to combine operating ease and speed with rugged build that can take severe service.

Furthermore, they are engineered to meet specific conditions in YOUR mine!

Ask for Bulletin RD-1

C.S. Card Iron Works Co.

Denver 1, Colorado

Warm Springs Mill

The Sun Valley Mining Co., at Hailey, Idaho, is erecting a milling plant in the Warm Springs district preparatory to milling a large tonnage of dump ore from the leased Sunday mine and development ore from its own property.

Basic Refractories

Installation of a huge kiln and other units for processing magnesite is progressing at Basic Refractories property in the Gabbs district about 17 miles north of Luning, Nev. More than 500 men are reported employed on the project, scheduled for completion this year. Furnace lining materials and other products turned out by the plant will supply markets developed by Basic Refractories from the Pacific Coast to the Mississippi river.

Norman E. Hansen, general manager for Basic Refractories, said recently that demand for the refractories has vastly increased in the west where steel and other industrial plants have been built in late years, and that calcining magnesite at Gabbs will reduce shipping weight of the finished product by 58 percent. The company expects to employ 150 men in mining and treatment of ore from its brucite and magnesite deposits, said to be the largest in the western hemisphere.

Shaft Sinking Contract

Contract for sinking a 16-ft diam air shaft at the No. 2 mine of the Utah Fuel Co., at Castle Gate, Utah, has been awarded Centennial Development Co., mining contractors of Eureka, Juab County, Utah, it was recently announced by James Quigley of the contracting firm.

Blackbird District

J. S. Vhay, geologist for the U. S. G. S., recently stated before a House public lands subcommittee that Calera Mining Co., a subsidiary of Howe Sound, has developed 1,750,000 tons of cobalt-copper ore in the Blackbird district of Lemhi county, Idaho, and estimates a possible production of at least 4,000,000 tons. According to Vinton H. Clarke, mining engineer for Howe Sound, the company will have expended $6,000,000 by the time it has completed the milling plant and cobalt refiners now being built at the mine and Garfield, Utah.

Billion Dollar Mining District

The Coeur d'Alene mining district of Idaho is rated as one of eight billion-dollar mining districts in the world, according to Henry L. Day, president and manager of Day Mines, Inc., in a talk before the Chamber of Commerce in Spokane. He credited the Coeur d'Alene district with a production record in excess of $1,300,000,000 and said that about 5000 men, currently employed in the district's mining industry and 30 milling plants, are engaged in processing the ore to concentrate form ready for smelting, and further stated that the district mines have paid their stockholders more than $200,000,000 in dividends.

Big Boulder Property

Operations are progressing at the Big Boulder gold property below Gold Valley, near Downieville, Calif., leased and optioned from E. Morris Vail of San Francisco by Security Gold Mining Co. Ninety of the 500 acres comprising the claims are covered with eroded material said to carry high gold values, which the management plans to move to the plant with a bulldozer. Manager William C. Ennis plans installation of a concentrator able to handle 300 cu yd of material daily.

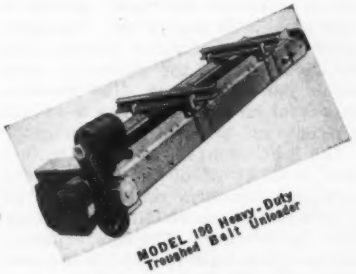
Placer mining is to be carried on and the gold veins worked later. The company plans development of an adequate water supply for mining and incidental domestic use at an estimated cost of $40,000.

PROMPT DELIVERY

Baughman HI-SPEED Conveying Equipment

This Ready-Mix Plant gets peak capacity with Baughman HI-SPEED Bulk Materials Handling Equipment. Three Baughman units — the HI-SPEED Belt and Bucket Elevator for the elevation of sand and gravel to hoppers . . . the Auger Type Conveyor carrying cement from the building to the truck under the hopper . . . the Heavy-Duty Undertrack Unloader charging the Belt and Bucket Elevator . . . All work as a team to make a very smooth, quiet and economical operation with HI-SPEED performance. Baughman standardized production methods cut your equipment costs. Quality materials and expert construction minimize your maintenance expenses.

Write for FREE catalog No. 57 on sectional conveying equipment or see nearest Baughman industrial distributor.



MODEL 190 Heavy-Duty Troughed Belt Unloader

BAUGHMAN

BAUGHMAN MANUFACTURING CO., Inc.
91 E. ARCH ST., JERSEYVILLE, ILL.
"There is a Baughman Distributor Near You"

Manufacturers Forum

Joy Announces New Equipment for Low Coal

The Joy Manufacturing Co., Henry W. Oliver Building, Pittsburgh 22, Pa., announces a new line of high-capacity equipment for trackless mining in very low coal. The main pieces of machinery announced include the 20-BU-1 loader, the 8-SC shuttle car, and the 12-RB mobile cutter. All three of these machines feature low over-all height. The height of the 20-BU-1 is

20-BU-1 Loader

8-SC Shuttle Car

12-RB Mobile Cutter

24 in., while the 8-SC and 12-RB are 26 in. in height. An hydraulic roof-bolting drill with an over-all height of 26 in. is also available.

Despite its low height, the 20-BU-1 loader is said to have a maximum capacity of 8 tons per minute. Gathering arms and conveyor are separately driven to permit continued loading in case of shuttle car delay. The conveyor can also continue to load into the shuttle car if the gathering arms should jam in the face. The machine is crawler-mounted and has a swinging conveyor to facilitate loading.

The 8-SC shuttle car has a water-level capacity of 80 cu ft, with the operator's platform centrally located to provide equal visibility in either direction of travel. The new, tapered-end design is said to provide a minimum turning clearance. Other features of the 8-SC are four-wheel airplane-type brakes, hydraulically boosted steering, hydraulic adjustable-elevating discharge, hydraulically driven cable-reel, four-wheel drive, and four-wheel steering.

The Joy 12-RB is a rubber-tired mounted mobile cutting machine which can be supplied either as a bottom-cutter or a top-cutter. The cutter bar may be swung 90° to either side for slabbing operations. A 50 hp motor is provided for the cutter-chain drive. The 12-RB is both driven and steered hydraulically. Hydraulic bar-tilt, bar-lift, and limited boom-roll provide compensation for the irregularities normal to mine roof or bottom.

R & S to Build Coal Washing Plant in Italy

First ECA financed complete coal washing plant has been contracted by the Societa Mineraria Carbonifera Sarda of Italy with Roberts & Schaefer Co. of Chicago, Ill., through their foreign representatives, International Manufacturing & Equipment Co., Inc., N. Y.

Incorporating the most modern design in coal preparation, the plant includes screens, complete Baum Jig washing, retreatment of fines, Hydrotator Classifier and centrifugal dryers.

With a capacity of 500 tph run-of-mine coal, the plant will produce clean coal, middlings and refuse. The project includes: run-of-mine coal storage, stacking belt conveyor, reclaimed coal belt conveyor to washer, clean coal, middlings and refuse bins, complete building and plate work and piping. All equipment and material will be furnished from this country while foundation and erection will be done by the coal company under the supervision of Roberts & Schaefer Co. engineers.

This will be the first complete, modern American coal preparation plant in Europe.

New Mine Locomotive Headlamps

Increased production and greater safety in mines are benefits claimed for two new mine locomotive headlight lamps announced by General Electric's Lamp Department, at Nela Park, Cleveland, Ohio.

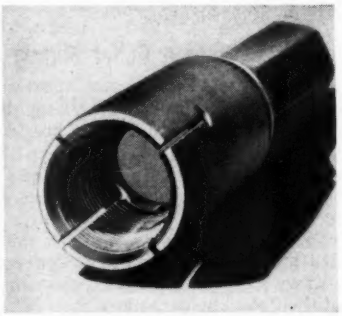
The new lamps are said to surpass headlights now in general use in beam candlepower, length of life, beam concentration, ruggedness of construction. They are 150-watt, PAR-46 bulbs, one of which operates on 32 volts and the other on 115 volts.

According to G. E. the 32-volt lamp has exceptionally high performance characteristics. It produces a beam of 100,000 candlepower, approximately three times that of a sealed beam automobile headlamp. The beam spread is 12 deg both vertically and horizontally, so concentrated as to be effective in mine haulageways, which average only six ft in height and 12 ft in width. The 115-volt lamp is intended for use in mine locomotive headlights equipped with resistors for this voltage only. Its beam of 17,000 candlepower has a vertical spread of 16 deg and horizontal spread of 33 deg.

Since most mine power circuits are 275 volts dc, with a few 500 volts dc, proper resistors in series with both lamps should be selected to provide 4.69 amp. through the 32-v. lamp, and 1.30 amp. through the 115-v. lamp.

Rock Bit Hole-Saver

The Rock Bit Hole-Saver is used to reclaim lost bits and drill steel broken off in the hole so as to save redrilling the hole. Attached to a



threaded steel in place of a bit, its peculiar left hand, tapered threads cut into the metal of the broken rod and remove it quickly, easily and without jamming, according to the manufacturer, Rock Bit Sales & Service Co., 2514 East Cumberland St., Philadelphia 25, Pa. The tool is threaded for Timken H or D; Rock Bit R-1 or R-2 steel to fit the following size steels—(a) ⅞ in. Hex., ⅞ in. Q. O.; 1 in. Hex., 1 in. Q. O., 1⅛ in. Rd.; (b) 1¼ in. Rd. and 1⅛ in. Rd. The manufacturer claims that the Hole-Saver has been field proved and rigorously tested.

Stephens-Adamson Marks Golden Anniversary

This is the Stephens-Adamson Mfg. Co.'s fiftieth year in the production of materials handling equipment at their Aurora, Ill., plant. The company began operations in a single 80 by 120-ft building in June of 1901, and today occupies a 13-acre site with 230,000 sq ft of plant space. Branch plants are located at Los Angeles, Calif., and Belleville, Ont., Can., with sales offices in principal cities in the United States and throughout the world.

Through the past fifty years, Stephens-Adamson has made many important contributions to progress in the materials handling field. In 1907 the company equipped the first commercially successful self-unloading bulk freight boat on the Great Lakes. That same ship is in service today, along with a large fleet of others similarly equipped.

By 1910, in recognition of the need for high capacity equipment, S-A had built a bucket elevator rated at 1000 tph. It has been handling a million tons a year ever since. Anti-friction, ball-bearing equipped, belt conveyor carriers were introduced by the company in 1911 to overcome excessive power demands of early belt conveyors.

These exploits have been followed by others down through the years, among which are a four and one-third mile belt conveyor to carry coal underground from mine to barge loading dock; a manganese steel feeder, first marketed in 1924 and now used by 90 percent of all western metal mines; conveying and screening equipment for one of the country's largest limestone plants; and the Sealmaster ball-bearing unit used on all S-A equipment and distributed throughout the world.

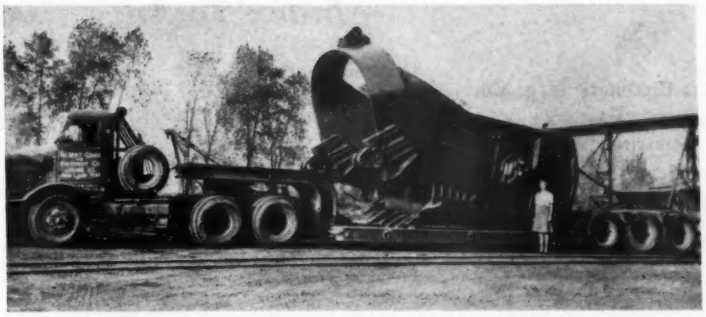
Along with equipment which has found such wide use in the mineral industry Stephens-Adamson has developed other specialized devices used by chemical and food-handling industries.

New Contracts to Wemco

New contracts for mobil-mills have been awarded Western Machinery Co. of San Francisco, by Hart & Hart Coal Co., Providence, Ky.; Valley View Coal Co., Pittston, Pa.; and W. S. Moore Co., Virginia, Minn.

At the Hart property an 8-ft by 6-ft Wemco Drum Separator will be the heavy media separatory vessel. The plant will have a washing capacity of 150 tons per hour. Approximately 125 tons per hour of 6 in. by ¼ in. coal will be washed in the Mobil-Mill and 25 tph of ¼ by 0-in. coal will be washed by tables also being designed for the plant.

At Valley View Coal the new washer will incorporate a 10 by 8-ft Wemco Drum Separator and use magnetite as the heavy medium. Washing capacity will be 170 tph of 2 by 3/16-in. coal.



One of the largest all-welded, automatic drag line buckets in the country is shown ready for shipment. The 25-cu. yd. bucket is made of high-strength rolled steel and Hadfield castings. The bucket was manufactured by Page Engineering Co. of McCook, Ill., with General Electric arc-welding equipment

At the Iron Range property of W. S. Moore Co., the 4M Mobil-Mill will be designed with an 8 by 6-ft Wemco Drum Separator and will treat iron ores at a rate of approximately 150-175 long tph. Feed to the heavy media plant will be sized to minus 2 in. plus ⅛ in.

Conveyor systems, crushing plant, and washing and feed preparation sections will be designed and furnished by Wemco, who also will supervise construction of the new plants.

New Grinding Wheel Bond

A new vitrified bond for grinding wheels and mounted wheels, "79E," is described in a 4-page folder just published by Chicago Wheel & Mfg. Co., 1101 West Monroe Street, Chicago 7, Ill. The folder outlines advantages and applications of the abrasive development, claiming a 5 percent to 10 percent increase in grinding and finishing output.

New Gyratory Crusher

A new line of gyratory crushers—the "Superior"—for ore and rock products has been announced by Allis-Chalmers Mfg. Co., 972 S. 70th St., Milwaukee, Wis. Constructed of cast steel, the new machine is said to provide increased crushing ability, improved crushing chamber and greater flexibility of installation and range of adjustment. These advantages are gained through improved design of shells and spider which permit the main shaft to be raised as wear progresses on mantle and concaves. A plastic dust seal and high-lead bronze bearings for eccentric and bottom plate are featured.

The dust-tight oil tank on which are mounted pressure-type oil filter and condenser-type cooler are located outside the crusher for easy accessibility.

The "Superior" line includes heavy and standard duty primary as well as 11 sizes of secondary crushers.

— *Announcements* —

The Minnesota sales and service branch of the **Euclid Road Machinery Co.** has moved to a new building on Highway 169 West in Hibbing. This branch is under the management of **J. W. Bloomquist. D. R. Anderson** is in charge of parts and **Otis Hadlock** is service manager.

Paul E. Young has been appointed director of purchases at the **Timken Roller Bearing Co.**, succeeding **Dwight A. Bessmer**, who was recently named assistant to the president. **R. J. Archibald** has been named assistant general purchasing agent.

District offices of **Mine Safety Appliances Co.** in Bluefield, W. Va., are now located at 1513 Bluefield Ave. The area served by this office includes Bluefield, Logan, Huntington, Mount Hope, Charleston and Williamson, W. Va., and Norton, Va.

Robert A. Harris has been appointed chief improvement engineer in the **American Car & Foundry Co.'s** production department.

Victaulic Co. of America has moved its general office from 30 Rockefeller Plaza, New York 20, N. Y. to 1100 Morris Ave., Union, N. J. where it is combined with plant facilities. The new mailing address, however, is Box 509, Elizabeth, N. J.

Link-Belt Co. announces that **Charles W. Beauchamp**, formerly assistant sales manager, Ewart plant, Indianapolis, silent chain drives, has been appointed assistant sales manager, Ewart plant, for both silent and roller chain. **H. Merrill Bowman**, formerly assistant sales manager at the company's Pershing Road plant, Chicago, has been appointed assistant sales manager, Ewart plant, for Ewart general products.

—Index To Advertisers—

	Page
Allis-Chalmers Mfg. Co.	6–7
American Brake Shoe Co. (American Manganese Steel Div.)	80
American Car & Foundry Co.	25
American Cyanamid Co.	78–79
American Cyanamid Co. (Explosives Dept.)	Insert Between 28–29
Anaconda Wire & Cable Co.	11
Baughman Mfg. Co., Inc.	125
Bemis Bro. Bag Co.	117
Bituminous Coal Institute	77
Bowdil Co.	10
Bucyrus-Erie Co.	15
Card Iron Works Co., C. S.	124
Cardox Corp.	30–31
Centrifugal & Mechanical Industries, Inc.	116
Chicago Pneumatic Tool Co.	Insert Between 28–29
Deister Concentrator Co., The	120
Edison, Inc., Thomas A. (Storage Battery Div.)	117
Electric Storage Battery Co., The	4
Euclid Road Machinery Co., The	29
Gardner-Denver Co.	Third Cover
Goodman Mfg. Co.	13
Hendrick Mfg. Co.	26
Hoffman Brothers Drilling Co.	128
Hollingshead Corp., R. M.	24
Holmes & Brothers, Inc., Robert	119
Ingersoll-Rand Co.	16
International Harvester Co.	12
Jeffrey Mfg. Co.	20–21
Joy Mfg. Co.	2–3
Kennametal, Inc.	23
Le Roi Co.	8–9
Link-Belt Co.	Second Cover
Mack Trucks, Inc	28
Macwhyte Company	115
Mine Safety Appliances Co.	Back Cover
Mott Core Drilling Co.	128
Myers-Whaley Co.	1
Ohio Brass Co.	22
Paris Mfg. Co.	121
Pennsylvania Drilling Co.	128
Pierce Equipment Sales Co., Roger	123
Read, Davis	119
Roberts & Schaefer Co.	18–19
Rock Bit Sales & Service Co.	122
Salem Tool Co., The	26
Standard Oil Co. (Indiana)	27
Timken Roller Bearing Co.	14
United States Rubber Co.	17
Universal Vibrating Screen Co.	128
Victaulic Co. of America	116
Western Insulated Wire Co.	123
Woomer & Associates, J. W.	119
Young, L. E.	119

Established 1902

HOFFMAN·BROS·DRILLING·CO.

CONTRACTORS

DIAMOND CORE DRILLING

PUNXSUTAWNEY, PA.

Our specialty—Testing bituminous coal lands
Satisfactory cores guaranteed

CORE DRILLING

ANYWHERE

"We look into the earth"

PENNSYLVANIA DRILLING COMPANY

PITTSBURGH 26, PA.

CORE DRILLING

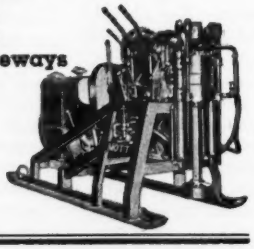
CONTRACTORS

Testing Coal Properties a Specialty
Guaranteeing Satisfactory Coal Cores

Pre-grouting mine shafts

Large diameter holes for
Drainage, Air-shafts and Escapeways

Inside Mine Drilling



MOTT
CORE DRILLING CO.

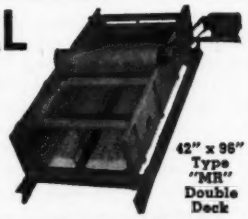
Huntington, W. Va.

UNIVERSAL

VIBRATING SCREENS

FOR *CLEAN* AND

ECONOMICAL SIZING



42" x 96" Type "MR" Double Deck

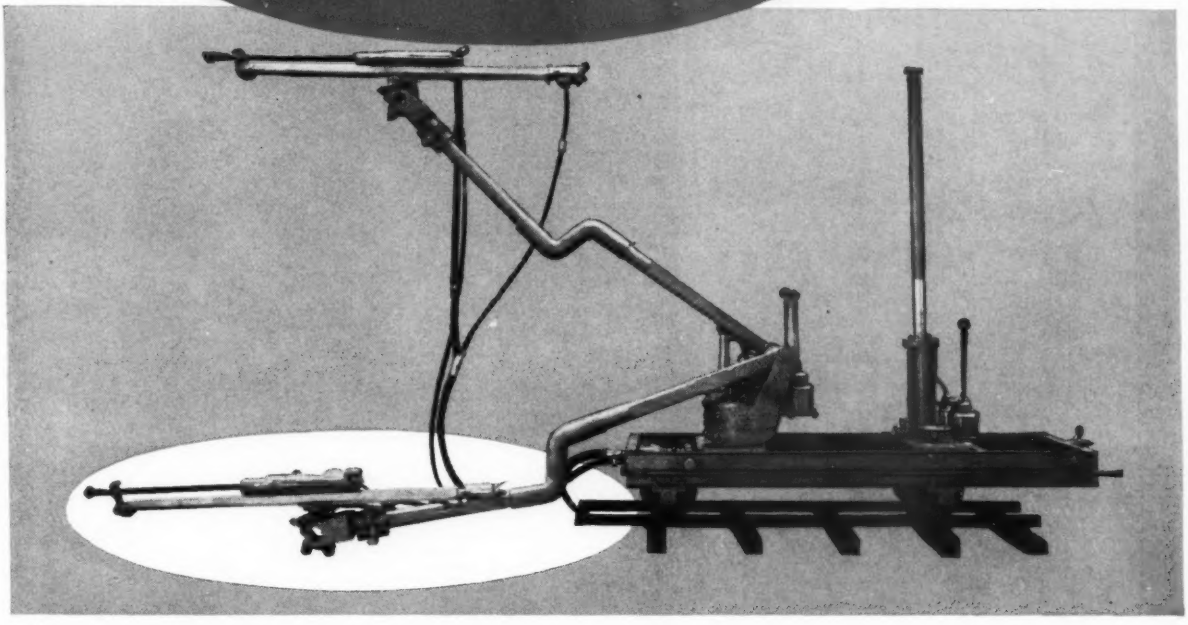
Write today for Catalog No. 109 on Screens and Screening.

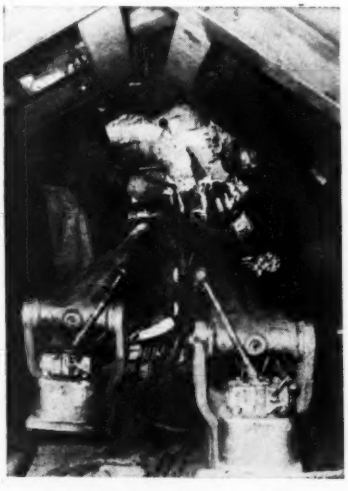
UNIVERSAL VIBRATING SCREEN CO.

RACINE, WISCONSIN

GIVE YOUR LIFTERS A LIFT!

Complete truck-mounted units include hydraulic roof jack and either one, two or three drill booms.





Hydraulic boom and roof jack units are available separately for mounting on your own custom-built jumbo.

These offset booms are great time-savers when you're drilling the lifters. Your runner doesn't have to take time out to swing the drill under — steel is easily and quickly centered on *every* hole in the face.

And that's only one of the *many* big advantages of Gardner-Denver Hydraulic Drill Jumbos. Other features include:

- **Faster set-up—move in and start drilling.**
- **Faster tearing down—release hydraulic pressure and the jumbo's off to another heading.**
- **"Creep-free" booms—hold steel steady and true.**
- **Hydraulic roof jacks—hold truck on-the-spot.**
- **Handle long feeds—up to 10-foot steel changes—for efficient use of tungsten carbide bits.**

Write today for complete information.

SINCE 1859

GARDNER-DENVER

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

There's an important connection between Your Production and Our Research

Because of the M.S.A. Research Laboratory, a lot of miners are going to keep on living. The primary purpose of M.S.A. research is to constantly expand and improve the means of combating worker hazards.

This aim alone completely justifies the activity . . . but there is another benefit, also because of the M.S.A. Research Laboratory, a lot of extra production will flow from the nation's mines. The improved safeguards developed by the program let the miner concentrate on his *work*. By reducing the human cost of the operation—the dollar cost drops, too. The money spent for safety, like bread cast upon the waters, returns many-fold.

Mine management today is concerned with expanding and extending mine safety which further expands and improves production, to combat sky-rocketing costs. M.S.A. products, with the extra safety added by research, provide a proven means of reaching these goals.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS and MEADE Sts. . . . PITTSBURGH 8, PA.

At Your Service:

54 BRANCH OFFICES in the UNITED STATES and CANADA

MINE SAFETY APPLIANCES CO. OF CANADA LIMITED . Toronto, Montreal, Calgary, Winnipeg, Vancouver, New Glasgow, N. S.

MINE SAFETY APPLIANCES CO. (S.A.) (PTY.) LTD. . Johannesburg, South Africa; N'Dola, No. Rhodesia; Bulawayo, So. Rhodesia

Representatives in Principal Cities in Mexico, Central and South America
CABLE ADDRESS; "MINSAF" PITTSBURGH

When you have a safety problem, MSA is at your service. Our job is to help you.

MSA

SAFETY EQUIPMENT HEADQUARTERS